POPULATION DYNAMICS OF PLANT PARASITIC NEMATODES ASSOCIATED WITH IMPORTANT FRUIT PLANTS IN RELATION TO VARIOUS ECOLOGICAL FACTORS AROUND ALLAHABAD

THESIS SUBMITTED FOR THE DEGREE
OF

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UNDER THE SUPERVISION OF :
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M.Sc.

DEPARTMENT OF ZOOLOGY
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ALLAHABAD
2001

Samarpit Sadar

maa aur pitaji
ke
sri Charno me

CERTIFICATE

Certificate

I take pleasure to certify that the studies entitled **"Population Dynamics of Plant Parasitic Nematodes Associated with Important Fruit Plants in Relation to Various Ecological Factors around Allahabad"** were conducted by **Mr. Ajay Kumar Tiwari** as presented in the present thesis under my supervision. The results and observation reported by him are genuine and the script of the thesis is therefore in full conformity with rules and regulations of the university of Allahabad and is forwarded for the award of the degree of Doctor of Philosophy of science of the university of Allahabad.

I wish him all success.

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Contents

CHAPTER 1

INTRODUCTION

CHAPTER ONE

INTRODUCTION

The various environmental factors responsible for distribution of a species at the same time also determine the number of individuals that can be present in the designated area. This factor is also responsible for the population dynamics of nematodes. Endoparasitic nematodes within the plants are largely in influenced and at the same time other environmental factors should not be ignored. The present thesis comprises of work done keeping the above facts in view. These studies had been carried out on predominant nematodes occurring in the rhizospheric soil of plants and the samples collected from different horizontal distances and vertical depths during June 1997 to May 1999.

Various environmental components, which act as limiting factors for the distribution of a species, are the same as those that determine the number of individuals within the area of their distribution. This is an important point because whenever we read about the influence of environment on the population density of a particular nematode at the same time we collect the information about the distribution of the nematode. Distribution of nematodes in space is thus, to a very large extent, a consequence of environmental influence. Although distribution of nematodes within the plant is probably influenced to a large extent by preference for particular types of tissues, it would be wrong to assume that other factors are of little importance.

Nematodes, as one component of the soil ecosystem interact with biotic and abiotic factors, producing economic crop losses but also having many other effects largely unknown. The plant parasitic nematodes are soil-inhabiting microscopic round worms that feed on plant roots **(Agrios 1959)** (worms that feed on plants root) are the parasitic worms.

All plant parasitic nematodes characteristically have a feeding apparatus known as a style(**(Bird 1971)**. The feeding activities of these nematodes usually result in stunting and unthrifty plant growth, reduced plant yields or crop yields and occasionally plant death. One estimate

of crop losses due to nematode parasitism was $ one billion year in the U.S.A. alone **(Anon 1968)**. Equally important nematodes can attack plants in combination with other disease-causing microorganism (Fungi and Bacteria) and some nematodes transmit plant viruses. The combined effects are more destructive to plant then the damage caused by the parasites separately. The role of nematode community in ecosystems is essential knowledge for managing plant nematode population **(Jones 1973)**. Clarifying the role of nematode in disposing Algae, Fungi, Bacteria, Phages and viruses **(Wasilewska and Webster 1975, Wilt, Joshi and Metcalf 1973)** decreasing energy input to forming disposing of organic wastage **(Marshall 1973)** and dealing with nematode tolerance to nematicides **(Smolik 1978)** keys to understanding the role will be knowledge of the distribution and diversity of nematodes in ecosystems as well as their population dynamics and their influence of food sources.

Information about the distribution and the population dynamics of the nematodes in the hosts, helps us to understand the extent of damage caused by them to the host plants out side the host, the distribution and abundance of nematodes is important, as it finally determines the total impact of the parasites on the host.

Soil nematodes communities usually are much more diverse then those of other soil mesofauna **(Nielsen 1949, Wasilwska 1971, Yeates 1967, 70)** indicating that cohabiting species of nematodes must occupy different niches by partitioning resources (Niche-dimensions) between species and tropic groups or through-different tolerances of environmental conditions **(Niche-breadths)**.

To explain why the numbers of nematodes are high in one place than another is a familiar, but a difficult ecological problem. There are so many environmental components that could influence the nematode in any situation. It is quite likely that several of them together do infact have some influence on the distribution and abundance of a particular nematode or nematodes. Satisfactory explanation of distribution must there for take into account as many as possible of these components and further more causes their relative contribution to the observed

distribution. However, from previous records it may be possible to deduce possible reasons for distribution patterns in a particular zone.

The ecological niche on an organism is both the space occupied by the organism and its functional role in the community thus there are spatial, tropic, habitat and other aspects of the niche. The niche is defined by all of the different factors (niche dimensions) affecting the organisms. The niche is multi-dimensional in space and time. Thus the complexity of the nematode community depends on the number of niche dimensions and differences in niche breadths between cohabiting species. The most obvious niche dimension is food source. Nematodes occupy almost every tropic level from primary consumer to higher order predator **(Twinn 1974)**.

The making surveys of nematode distribution and in any field problem the most obvious factor that needs to be studied in the soil type. There are infact a large number of references to correlate the distribution and abundance of various plant nematodes and the sort of soil from which they were recovered.

Other physical factors interacting with nemic population dynamics viz. Temperature, moisture, wind, water current, water depth, soil-structure drainage, aeration, chemical factors like composition of the habitat, pH minerals, fertilizers, pesticides and biological factors like interaction among nematodes between nematodes and other organism as well as preference of characteristic habitats and hosts, vertical distribution, altitude, seasonal distribution, seasonal variation etc were recognized quite early since the beginning of this centaury **(Sesser and Jenkins 1960, Wallace 1973, Norton 1978)** modern ecology is primarily concerned with an understanding of ecosystem functions and has turned out to be a dominant force in exerting strong influenced on other branches of natural and social science.

Cohn 1969 attributes this to the fact that the smaller species occur in the heavier soil where as in the lighter soils, nematodes of greater body volume are more abundant. **Cohn** suggests that O_2 content and water holding capacity might determine the ability of a species of *Xiphinema* to survive. Thus larger nematodes might required

well-aerated soil and may not survive in the heavier clay soils. Although **Cohn** does not say in so many words why large nematodes requires a well-aerated soil. He is presumably thinking of relative decrease in surface area to volume of the body as nematode increase in size and the consequent relative reduction in available area through which gasses can diffuse through the cuticle. Thus it is not soil types that .determine distribution and abundance of nematodes but some other factors associated along with soil type.

The phytonematodes usually typically have a patchy distribution within infested fields **(Barker** and **Campbell 1981, Godell** and **Ferris 1980, Mc. Sorley** and **Parrado 1982)**. This characteristic affects the precision of sample estimates of nematodes population densities **(Barker** and **Campbell 1981, Mc. Sorley** and **Parrado 1982)** Here after Called nematode-densities or more simply densities **(Noe** and **Barker 1985)** and the accuracy of resulting yield-loss estimates in management-advisory systems. Analysis of the relationships between variation in soil parameters and the irregular special patterns of plant parasitic nematodes is lead to an important improved understanding of how these organism interact with the soil environment. This information .may also be used to improve precision in nematode-assay methods by allowing compensation for soil-parameter effects.

Some of the major acts that were seen to be relevant in this regard are soil texture, soil structure, air and soil temperature, rain fall, soil moisture evaporation, soil conductivity, pH plant materials and topography.

Although protein characterization has full-filled the expectations for species identification, little attention has been paid to the comprehensive amino acid differentiation between phytonematode genera and species. **Smitts** and **Barker 1988** demonstrated the significance of contrasting protein characteristics in morphological evolution of cyst nematodes. The qualitative and quantitative variations in amino acids in plant tissues was found responsible for increasing or .declining resistance to words phytonematodes infection **(Ridge and Osborne 1971)**. Several workers have emphasized the necessity of a

Phylogenetic approach in order to arrive on more stable classification systems **(Clifford and Stephenson 1975)**. It is now very well known that Biochemical techniques can be a powerful toll to construct phylogenies **(Sites, Bickham, Pytel, Greenbaum and Bates1984)**. There for an attempt was made in this study to evaluate amino-acid variations at species and generic levels, which can latter elucidate morphological variations amongst phytonematodes and thus could be helpful in providing authenticated account of phytonematode systematic.

The vertical distribution of nematodes must also been taken into account because some species appear to prefer certain depths. **Richter (1969)** found that *Trichodorus* occurred in greater numbers in the deeper soil levels or soil layers compared with species *Tylenchorhynchus* and *Pratylenchus*. **Fleg (1968 a)** found the *Xiphinema diversicaudatum and X. vaittenezi* decreased in numbers with increasing depth where as *Longidorus macrosoma* increase with depth up to 70 cm. **Koen (1966)** found that the seasonal variations from summer to winter and the consequent change of soil moisture influenced the pattern of vertical distribution of *Meloidogyne javenica* in the soil. During winter the highest population density was found at a depth of 30-45 cm compared with 15-30 cm during summer.

To some extent densities of nematodes represent a response to the soil environment. Soil microsites with varying physical and chemical parameters may have differential effects on the nematode or host plant. The importance of nematodes in the forest soils has for the most part-received only superficial attention. Worldwide demanded for the wood products are increasing at the same time society is placing more diverse demands on forested lands. Recreation and watershed uses to forest land take precedence over wood production in some areas large area of prime hard wood forest are being converted to other uses for example - Agricultural, urban and industrial development, and utility rights of way. These factors have motivated foresters to seek methods of maximizing production of lands that are available for forestry prepossess. Nematodes community relationships among selected

forest woodlots are determined by the resemblance equation that is discussed by **Johnson, Ferris and Ferris (1973)**. This techniques based on the presence or obscene of a species and gives rare species .response or species importance equal to that of frequently found species sites very similar in species composition may still be quite distinct ecologically. The number of individuals of each species in a habitat provides an estimate of a species importance in the community **(Beals 1960)**.

The objective of the present investigation there for was to assess the influence of the various soil and environmental factors on the number of parasitic nematodes. However no attempt has been made here to study the effect of soil or soil types on the distribution, density and population dynamics of plant parasitic nematodes. The results of the analysis of the data indicated soil temperature and soil moisture were most consistently correlated with the nematodes and at a time two or more of these factors were responsible for building up peak .population. There was also indication that the highest numbers of nematodes were usually found at optimum soil temperature and soil moisture.

Although the task of elucidating the ecology of distribution of nematodes is a formidable one, it is not impossible if the work is undertaken in a systematic manner.

Most plant parasitic nematodes leave in the soil where fluctuation in soil temperature and soil moisture decreases rapidly with depth, hence spectacular climatic changes above ground are likely to be less hazardous in the soil. More over Nematodes have the ability to migrate vertically in response to physical gradients and so escape the hazards, hence the session changes in vertical distribution of nematodes play an important role in determine their ability to build up their population. .Little information is available on plant nematodes or plant parasitic nematodes associated with important fruit plant Viz. *Psidium guajava, Zizyphus jujuba and Carica* papaya in a typical Indian sub-humid region.

The present investigation is an attempt to study the details of distribution dynamics of plant parasitic nematodes associated with important plants crops. The fallowing aspects of the plant parasitic nematodes ecology were investigated: -

A. The effect of different ecological factors viz. soil temperature, soil moisture in order to evaluate the density and density independent factors on the plant parasitic nematode population dynamics.

B. The effect on the sex ratio of plant nematodes associated with different fruit crops.

C. Horizontal and vertical distribution of plant parasitic nematodes associated with above-mentioned fruit crops.

D. Bio-statistical significance of the influence of season, soil temperature, soil moisture and nematode population has been worked out.

CHAPTER 2

HISTORICAL REVIEW

CHAPTER TWO

HISTORICAL REVIEW

Plant eating nematodes cause damage which is difficult to measure because the soil factors enterfears with the plant parasite relation ship as nematodes can move easily and the plants uptake water and nutrients. As for as industrial crops are concern the use of resistant varieties and nematicides will increase the crop yield. The distribution of plant parasitic nematodes is related to the type of soil. The presence of a plant does not determine which type of nematode species will occurs in the soil but it is difficult to make use of such relation ship as soil texture in the field can not be altered. Fallowing is a technique to restore soil structure increase organic matter and controlled the population of nematodes. Nematodes depend upon particular plant under suitable soil conditions and it is easy to evaluate their population making them important bio indicators. Widespread use of run of water caring useful organize is our particular interest along with the use of nematodes as indicators of fertile soils. It is also useful for evaluation of sustained agriculture.

It is difficult to decide if nematodes are causing or lightly to cause a plant growth problem. The role of nematodes in unsatisfactory plant growth is difficult to determine by nematode diagnosis because few nematodes produced diagnostic symptoms. Symptoms alone cannot tail if the nematodes are causing damage because other factors can also induced similar symptoms. Therefore, diagnosis should include the symptom produce above and below growth ground, field history and soil, and root analysis nematodes should not be made totally responsible for poor plant growth. It is always possible to say that the nematodes are the cause of poor plant performance specially when it has been officially announced that nematodes are present in large number and show it is they who are responsible many other factor can cause same type of symptoms as produced by the nematodes and these factors may be working alone or in consumption. Even if the number of nematodes is high and the problems persist it is quit

possible that increase nematodes reproduction can be the result or the cause of increased plant stress. Even in the condition when nematode population is greater then normal because of plant stress cause by persistence environmental factors like cultural particles, soil conditions, other diseases or pests, separation of nematodes number by chemicals without correcting the fundamental cause will not provide a long term solution.

Above ground symptoms is not sufficient evidence to diagnose a nematodes problem however they are important because problems caused by nematodes are first noticed in abnormal growth of the plant. Certain kinds of symptoms like injury to roots by nematodes can also be considered as a possible cause of inferior performance. It can also be used to locate severally affected areas in the field after the problem is diagnosed. Most plant nematodes affect the function of the root and therefore most of the above ground symptoms due to nematodes are the result of improper water supply and mineral nutrition include wilting under moderate moisture stress there is slow recovery in the wilted areas after rains or irrigation and there is gradual decline in the plants. Leaves become yellow or some times show symptoms of nutrient deficiency. Area damaged by nematodes is more visible during stress periods such as extreme heat or drought. There are other factors, which cause root stress like, pathogenic fungi, insects, deficiency of minerals to much or to little water shady places soil compaction or injury due to chemicals may produced symptoms similar to nematode injury. The pattern of damage may be a clue for the presence of nematodes in the soil because nematode populations are distributed unevenly in the soil and thus above ground symptoms also varied in size and shape. Nematode damage neither is observed in areas under special stress de to heavy traffic, excessive or poor drainage, slope, soil structure and in areas not coming under irrigation damage due to nematodes neither uniform nor ends abruptly. The problem within areas with distinct boundaries representing treated and untreated area with nematicides or other man made changes in the soil below ground symptoms are more use full then above ground symptoms for the

diagnosis of nematode related problems. Roots injured by nematodes are usually dark short with few lateral roots. The root tips may become swollen and there is excessive root rot. Short roots can also be due to migratory endoparasite when lesion or lance nematodes caused extensive physical wounds in the cortex of the host root tissue fungi which are unable to enter the host root tissue are able to colonize the entire root system. The Tip of the root which become rotten are due to endoparasitic nematodes or root rot fungi and not by ectoparasitic nematodes root knot nematodes injured and reproduce in many grasses but do not produce galls on the roots absence of such galls does not indicate that root knot nematodes have caused the damage.

The vertical distribution of Nematodes in observed soil depends upon two measure factors the intensity and the depth of the root system this is accompanied by the movement or transport of nematode larvae added by the soil factor on which the root development depends. Cultivation of soil disturbs the patterns of distribution but soon the population of nematodes is restored at different depths. The variation in root system of different fruit plants and the type of nematodes attacking the plats make the vertical distribution of nematode variable the nematodes are largely distributed in the top layer of the soil from 0-25 cm in depths but some of them have been reported up to 8 meter's below the soil surface the top surface layers of sandy soils contained minimum number of nematodes because of the absence of plant, roots and the extremes of weather to which these soils are subjected in uncultivated soil most of the nematodes are recorded from 5-8 cm and up to 50% of this population is found in one cm of the top layer. In potato cyst of *G. rostochiensis* are related to the amount of root system with large to the amount of root system with large numbers been found at 5 cm below the soil surface. No cysts have been reported below 20 cm. The citrus nematode *Tylenchulus semipenitrens* may occur as deep as 2.4 mts depending upon the depth of the root penetration this is dependent upon the soil type the largest number of barrowing nematodes are similes in a citrus orchard are found.3 to 1.5 mts. below the soil surface but some are found on the feeder roots as deep as 3 to

·3.16 mts. Difference in vertical distribution varies in different species. Some may be found at depths where the number of other nematodes is almost nil. Vertical distribution of some species depends upon the attraction of nematodes for the root system there fore the amount of roots had a particular depth will decide the population which will be present root systems of plants infested for a long time will be less then in recently invested plants and the nematodes associated with recently infested plants will be greater in number then those infested for a long time.

During the nineteenth century, ecology was just beginning to attain a self-conscious state. In the nineteenth and early part of twentieth century's natural history and life history emphasized the importance of the study on population biology **Alexander ·Vonhumboltd (1769-1850)** was the first to consider plants in respect to there natural surroundings. With the advance of animal ecology during twentieth century it becomes apparent that certain ecological problems could not be solved by investigation either through autecological approach or through that of animal community studies. These problems on recognition and exploration rapidly grew in to the present active field of population ecology. The study of population dynamics, so important in modern ecology in the fact dates back to **Mathews**, who pointed out in 1798 the limitation to population growth by the pressure exerted by available food.

The species of plant parasitic nematodes, their population density's, and there potential for damaging crops vary considerably from field to field. The kinds present and population densities in soil are ·greatly influenced by past cropping history and various environmental factors such as soil type, moisture, and temperature. Assays of soil samples from follow fields or from the rhizosphere of plants showing nematodes damage usually revel 2 to 9 genera of plant parasitic nematodes **(Sasser, Barker and Nelson 1975).** Occasionally one species may be dominant, but in most cases, a mixture of several genera and species appear to be attacking the host crop and contributing to the overall disease complex. There have been only

limited investigations of the interactions among nematodes in such polyspecific communities and most of these were done in the laboratory or greenhouse **(Johnson** and **Nasbaum 1970, Kinloch** and **Allen 1972, Turner** and **Chapman 1972, Gay** and **Bird 1973)**. **Seinhorst (1970), Nausbaum** and **Barker (1971)** have summarized the extensive researches on population dynamics of nematodes. Relations between nematodes population density and plant damage also have been studied for certain nematodes host combinations **(Seinhorst 1965; 1970, Oostenbrink 1966, Olthof** and **Potter 1972, Wong** and **Mai 1973, Ferris 1974)**.

Nematodes or ell worms are the most important non-insect pests associated with plant life causing extensive and intensive damage to plants ultimately leading to reduction in yields, is recognised all over the world. This fact remained unnoticed till fifty's except for a few recognized pests like Anguina and Hetrodera and the diseases caused by them were misinterpreted by worker's as viral or nutritional deficiency specially in India. The nematode parasites of higher plants represent only a small fraction of the total nematode fauna of the earth. The first report on plant parasitic nematodes was made by **Needham (1743)** when he reported the occurrence of nematodes inside wheat grains transformed in to galls. It was not until 1855 that **Berkeley** determined a root-knot nematode, *Meloidogyne* species, to be the cause of galls on the root of green house grown cucumber plants in England. **Schacht (1859)** reported the sugar beet cystnematode *Hetrodera schachti* from Germany **Butschli (1878) Bastin (1865)** and **De Man (1880)** are among the pioneers, who worked on Nematode Taxonomy. **Kuhn (1874) Barkley (1855) Atkinson (1892) Smith (1940), Stone (1961)** and others worked on root-knot nematodes, stem and bulb nematodes. **Neal (1889), Barber (1901)** may be mentioned as pioneer in the nematode plant relationship studies outstanding contribution of the Twentieth century have been made by **Cobb (1914), Chittwood (1950,74), Christie (1951), Steiner (1933), Thorne (1961), Goodfrey (1934), Allen (1957), Raski (1948), Goodey (1933,63), Goffart (1932), Seinhorst (1956), Oosteinbrink (1966), O. Fillipjev**

(1936) and **Sher (1954)** surveyed nematodes in Hawii and reported *Aphelonchoides, Hoplolaimus, Meloidogyne, Rhadopholus, Xiphinema,* ·*Pratylenchus* and *Tylenchorhynchus* on Strawberries, Banana, Tomato, Papaya and Several other crops. **Edna (1954)** reported the common names of some important plant pathogenic nematodes.

Ecological and parasitic adaptations as the key of Phylogenetic relationship **(Siddiqui 1986)** and biotic factors influenced pathogenicity **(Khan 1981)** have stirred interest in some reviewers seasonal fluctuations of nematode populations in relation to their environment have been studied in the by **Micoletzy (1922), Burkhalter (1928), Goheen** and **Williams (1955), Norton (1959), Ross (1962), Oostenbrink (1966), Das (1977), Saxena, Chhabra** and **Lata (1973) Muthukrishan** and **Sunderbabu (1979), Haung, De Souza** and **Campos (1984)** and others. **Goheen** and **Williams (1955)** found that *Pratylenchus* density reached its peak in the roots of brambles in June, ·after which it declined very rapidly and remained low through the summer, fall and winter until plant growth started again in spring. **Norton (1959)** correlated the fluctuation of *Tylenchorhynchus brevedens* density around wheat roots with rainfall, and **Minton, Cairns** and **Smith (1960), O. Banon, Radewald** and **Tomertin (1972)** and **Carneiro Lordello, Carneiro** and **Monteiro (1980)** analysed the regulatory rote of rainfall on nematode nemic population dynamics in soil. **Ross (1962)**, observed a marked decline in the population of nematodes above 90^0F and a population rise at 90^0F. **Oosteinbrink (1966)** discussed the seasonal fluctuation in *T. dubius* and related it to plant growth rather then to influence of other factors, which edaphic factors have been worked out by **Trevathan, Caurezma, Teran** and **Gourley (1985)**. The densities of plant nematodes have been ·correlated with a visual index of soil texture in an alfalfa field **(Goodell and Ferris, 1980)**. Differences in soil pH **(Bird 1959, Bargman** and **Von Duren 1959, Klinger 1961, Townshend 1964, Edmunds 1967, Ferris, Ferris, Bernard** and **Probst 1971, Norton** and **Schmitt 1974, Norton, Fredrick, Ponchilla** and **Byhan 1971, Jairajpuri** and **Azmi 1978, Kimpinski** and **Willis (1981)**. Caution exchange Capacity

(Norton et. al. (1971), percentage organic matter **(Mankau** and **Minter 1962, Taylor** and **Murant 1966, Norton et.al. 1971, Norton** and **Schmitt 1974)**. Soil Texture **(Ferris et.al. 1971, Norton et.al. 1971, Shivkumar** and **Seshadri 1972, Upadhyay, Oostenbrink** and **Khan 1972, Schmitt 1976, Norton** and **Schmitt 1974, Carter 1975, Santo** and **Bolander 1979, Chabra, Sidhu** and **Singh 1978** and **Prasad** and **Rao 1980)** and soil moisture **(Kable** and **Mai 1968, Von Guindy, Mc. Elory, Copper** and **Stolzy 1968, Upadhyay** and **Khan 1968, Gupta** and **Atwal 1971, Khan, Adhami** and **Saxena 1971, Schmitt** and **Norton 1972, Siddiqui, Khan** and **Saxena 1972, Norton** and **Schmitt 1974, Twinn 1974, Smolik 1982)** have been related to the relative abundance of nematode species in studies comparing soil sample from different places.

Goheen and **Williams (1955)** observed that the Pratylenchus density reached its peak in the root of Brambles in June, after whom it declined rapidly and remain low through the summer and winter until plant growth started again in spring.

Nematodes are subjected to a wide range of temperatures. Temperatures near the soil surface may fluctuate greatly both daily and in the top 20.0 cm by at 20^0-30^0C seasonally. Various nematode responses to temperature have reviewed by **Nicholas (1975)** and **Norton (1978)**. Temperature has been shown to affect: the Rate of development **(Bergeson 1959, Pillai** and **Taylor 1967, Sohlenius 1968, Bird 1972, Huang Huang** and **Lin 1972, Hopper, Fell** and **Cefalu 1973, Wong** and **Mai 1973, Griffin 1981, Morell** and **Bloom 1981, Kimpinski** and **Willis (1981), Smolik (1982))**, Generation time **(Pillai** and **Taylor (1967), Evans** and **Fisher (1970), Huang et. al. (1972))**, Egg production and Hatching **(Bergson (1959), Taylor (1962), Pillai** and **Taylor (1967), Sohlenius (1968), Evans** and **Fisher (1970), Banyer** and **Fisher (1971), Shepherd** and **Clarke (1971), Hopper et all (1973), Popoviçe (1973), Wang** and **Mai (1973), Von Hoff (1976), Greet (1978), Laybourn (1979))**, Sex ratio **(Meyl (1953), Griffin (1969), Laughlin, Williams** and **Fox (1969), Evans** and **Fisher (1970), Hensen, Boucher** and **Yarwood (1972), Greet (1978),**

Marques and **Huang (1986)),** Size **(Evans** and **Fisher 1970, Malek 1980)),** Chemical tactic responses **(Dusenberg, Anderson** and **Anderson (1978)),** Movement **(Rode (1969), Dusenberg et. al. (1978)),** Respiration **(Rode (1969), Anderson (1978), Laybourn (1979), Proctor (1987)),** and Infectivity **(Wallace 1969, Rebois 1973).** The effect of temperature on these responses varies for example generation time may be shortened and survival of eggs and larval may be greatly reduced at high temperatures (usually greater then 30^0C), but more males may be produced. Consequently even thought generation time is shorter, the size of the developing population may be smaller. Thus the population response may be the most suitable measure of optimum temperature because it reflects the summation of several processes affected by temperature. However cohabiting species in the soil environment have been found to occupy different temperature niche breadths **(Anderson** and **Coleman 1982). Parker** and **Mai (1956)** observed damage to tree fruits in Newyork by root lesion nematode.

The interrelationships of plant age **(Fawole** and **Mai 1979, Griffin 1981)** and light intensity **(Fawole and Mai 1979)** with population dynamics of phytonematodes have been discussed in literature. The influence of host plant on morphometric and allometric characters has been reported for several nematode species such as *Ditylenchus destructor* **(Goodey 1952),** *Pratylenchus nanus* **(Fisher 1975),** *Trichodorus christiei* **(Bird** and **Mai 1965),** *Hetrodera glycines* **(Golden and Epps 1965),** *H. rostochiensis* **(Turdgill and Parrot 1970)** and *Aphelonchoides frageriae* **(B' Chir 1977). Sasser (1972)** and **Davide (1980)** have studied the variation due to the host on morphometrics of *Meloidogyne incognita* **(Kafloid** and **White)** and *M. incognita* aerita **(Chitwood).** Host plant induced variations in the morphometrics of females of root knot nematode were established in nemic populations in India by **Singh, Singh, Yadav** and **Saxena (1985)** and abroad by **Tacconi (1969), Pogosyan** and **Keryptyan (1976), Grulton, Dickson** and **Esser (1976)** and **Davide (1980). Malik** and **Jairajpuri (1983)**

Marques and **Huang (1986))**, Size **(Evans** and **Fisher 1970, Malek 1980))**, Chemical tactic responses **(Dusenberg, Anderson** and **Anderson (1978))**, Movement **(Rode (1969), Dusenberg et. al. (1978))**, Respiration **(Rode (1969), Anderson (1978), Laybourn (1979), Proctor (1987))**, and Infectivity **(Wallace 1969, Rebois 1973).** The effect of temperature on these responses varies for example generation time may be shortened and survival of eggs and larval may be greatly reduced at high temperatures (usually greater then 30^0C), but more males may be produced. Consequently even thought generation time is shorter, the size of the developing population may be smaller. Thus the population response may be the most suitable measure of optimum temperature because it reflects the summation of several processes affected by temperature. However cohabiting species in the soil environment have been found to occupy different temperature niche breadths **(Anderson** and **Coleman 1982). Parker** and **Mai (1956)** observed damage to tree fruits in Newyork by root lesion nematode.

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have done statistical analyses of variability in various phytonematodes taxa.

Minz (1957) studied the distribution of nematode parasite of crops in Israel. Meloidogyne was wide spread and other important nematodes associated with fruit crops and cereals were *Aplenchoides, Criconemoides, Helicotylenchus, Ditylenchus, Hopolaimus, Paratylenchus, Xiphinema* and *Rotylenchus*. **Wehunut (1957)** studied population trends of nematodes associated with clove in Louisiana.

Any study of Nematode populations with repeated sampling has shown to contain up to 105 species **(Johnson, Ferris** and **Ferris 1972)** and 29,800,000 individuals per m^2 **(Voltz 1951)** must take into consideration the distribution in time and space not only of the nematodes but also of factors which may interact with them. The way in which each variable is measured may be crucial. There are many methods of extracting nematodes **(Chitwood, 1931, Hoagland** and **Arnon 1950, Jenkins 1964, Flegg 1967, Southy 1970, Hussey 1971, Lehman, Barker** and **Huising 1971, Byrd, Ferris** and **Nusbaum 1972, Coolen** and **D. Herde 1972, Esser 1972, Hussey** and **Barker 1973, Juhl 1975)** each with its own efficiency **(Barker Nausbaum** and **Nelson 1967)** and ecologists have an added problem of assessing whether the nematodes recovered were active at the time of sampling so their metabolic contribution may be assessed **(Nielson 1961, Freckman, Mankau** and **Ferris 1975, Smolik 1975)**. The typical aggregated distribution of all plant and soil nematode populations necessitates replicated sampling. Some nematologists worked with individual cores **(Johnson et. al. 1971, Yeates 1972)** and some bulk cores for extraction of sub samples **(Wasilewska** and **Paplinska 1976)** results are normally expressed per m^2 to a specified sampling depth with some estimate of variability. Environmental management commonly leads to changes in plant productivity and in total and specific nematode populations. Relationships between nematodes population size, rate of multiplication and the growth of host plants have been reviewed **(Barker** and **Olthof 1976, Jones 1973)** but those relate primarily to plant feeding nematodes in agricultural systems,

including their interaction with climatic stress. However comparisons of management regimes differing in intensity or the replacement of one ecosystem by another can give useful information on the components of the nematode fauna **(Yeates 1979)**. **Lordello, Lordello** and **Donalisio (1986)** concluded that 90% of 160,000 young seedlings of the jaborandi (*Pilocarpus microphyllus* starf) were lost due to the ·infestation of *M.incognita*.

Chandler (1958) and **Mowry et.. al. (1958)** has studied host parasitic relation ship of Psidium guajava, which is of great economic importance.

The forest industry has responded to increasing demands for wood and wood products by improving processing, utilization and production so that timber yields will be substantially increased per unit area and per unit time in anticipation of several limitations of non-renewable resources in the foreseeable future, interest has been focused on the feasibility of conservation by developing alternative renewable resources. To satisfy these needs silvi culture and forest management must become intensive enough to produce forests that grow at much nearer their biological capacities **(Bethal** and **Schreuder 1976)**. The inhibition of forest seedlings growth of plant parasitic nematodes has been established **(Goodey 1965, Hijink 1969, Ruchle 1969, Riffle 1970, Sutherland** and **Dunn 1970, Mamiya** and **Kiyohara 1972, Riffle 1972, Maggenti** and **Viglierchio 1975, Viglierchio** and **Maggenti 1975, Wang, Bergason** and **Green 1975, Viglierchio 1978,1979)**. Both industrial and public forest management has largely ignored the role of nematodes despite repeated demonstrations that they are important in the forest biome **(Ruchle 1972)**. **Viglierchio (1979)** argued the nature of response of the progeny of five strands of *Pondrosa pine, Pinus pondrosa* laws (var. Pondrosa) to 12 species of stylet-bearing nematodes. *Hoploliamus galeatus* has been shown to damage conifers by **Ruchle (1962)**. Tylenchorhynchus claytoni and Pratylenchus species showed intra seasonal cycles around red pine, P. resinosa aet. **(Southerland** and **Adams 1966)**. Studies of *P. radiata*

seedling indicated a correlation between decreased pasture herbage production and decreased total nematode abundance in 0-10 cm sol in plots containing more trees **(Yeast 1979), Wasilewska (1971)** reported nematodes in 6 of forest educes in Poland, 4 forms an establishment succession over 6-20 years, and the other 2 were 135 years old forests of differing composition. Nematodes abundance, biomass and metabolism had a strong positive correlation with soil humus content and the degree of vascular plant cover particularly in the early (and presumably more productive), stages of the succession although most markedly in plant feeding nematodes, Corresponding to a shift from 60% plants feeding nematodes at 6year to 15% at 17 to 20 years. .Fungivorous and plant feeders had maximum numbers in the spring. Bacterial feeders maintained relatively large numbers and biomass through out the year and omnivorous, fungivorous and plant feeders were reduced in winter. Omnivorous and Bacterial feeders made the greatest contribution to oxygen consumption. **Nielsen's (1949)** data indicated that with increasing vegetation cover and Humus level in a pine forest the bacterial feeders exhibited the a noticeable increase but omnivorous decreased, and the replacement of forest by posture in New Zealand increased plant feeding nematodes **(Egunjobi1971).**

Norton (1959) correlated the fluctuation of *Tylenchorhynchus* brividens density around wheat roots with rainfall. **Jons (1959)** considered soil temperature, moisture, aeration, and soil structure as the solvent factors affecting nematodes in soil. However, no detailed study was made to investigate the relationship with soil structure. **Bergason (1959)** studied the influence of temperature on the survival of some species of the genus *Meloidogyne* in the absence of a host.

Many soil parameters are strongly correlated **(Brady 1974)**. The impact of a single parameter cannot be isolated if only a few edaphic factors are observed. Measured effects may be due to an observed variable or may be the result of another correlated variable. Multivariate statistical methods have been developed for the analysis of enter correlated data sets **(Taylor Sasser** and **Nelson 1982)** conical variant analysis has been recommended as an appropriate technique

for the analysis of several data sets related to the same biological phenomenon **(Campbell** and **Tomenson 1983).**

Ross (1962) observed a marked decline in the population of .nematodes during July 1958 where the maximum air temperature was above 90^0 F and a population rise during July 1959-1960 where the temperature remained at 90^0 F. **Wallace (1962)** have suggested that nematodes can be divided orbitarly into 3 groups those that are active enough to swim in deep water those like Ditylenchus and Aphelenchoids that can swim in thick water films, escape from the soil and ascent plant above ground level. Finally those are too inactive to swim the crawlers, which are largely confined, to the soil.

The initial interest in mathematical nematode ecology in India was first enthused with a review by **Oostenbrink (1971).** Earlier **Mukherji** and **Dasgupta (1983a)** reviewed nematode ecology in India. **Wallace (1973)** identified four mathematical approaches to understand the spatial distribution of nematodes in a field:

- Resemblance equation,
- Community ordination to analyze relative density of different species at different species sites including different soil characteristics as determinate **(Ferris; Ferris, Bernard** and **Probt (1971)** and
- Stepwise regression. The approaches of experimental simulation **(Dalton** and **Nasbaum 1961)** and geophytonematology **(Whitehead 1969)** have not gained any attention **(Dasgupta and Rama 1987).**

Siddiqui (1963) conducted a survey of 13 district of U.P. to determine the species of nematodes associated with Citrus plants *Tylenchulus semipenetrans, Pratylenchus coffee* and *Xiphinema* were the most important nematodes recorded. In addition, Criconemoides *citri*, Criconemoides *parvulum*, *Hoplolaimus, Helicotylenchus, Pratylenchus* and some free-living forms were also observed. **Wallace (1963)** studied nematodes orient to a particular zone i.e. Soil horizon with optimum conditions. Thus, its multiplication and distribution in upper most layers may vary with session, affecting vertical distribution.

Edward and **Mishra (1963)** surveyed plant nematodes around Citrus, Mango, and Zizyphus in U.P.. **Baunge (1963)** studied the ecological importance of free-living soil nematodes with special reference to those of moorland soil.

Poisson distribution has been used as a measure for determination of variance of *T. claytoni* **(Barker and Nasbaum 1971).** The determination of species preference between Meloidogyne sp. and *Xiphinima americanum* in a grape vineyard was conducted by **Ferris** and **MC.Kenry (1974), Goodell** and **Ferris (1980,1981)** found that nematodes follow either lognormal or negative bionomical distribution of nematodes in the entire field or in textural groups or in 1m^2 grids were taken into account. Thus logical stratification of grids depending on soil physiography and cultural conditions appeared to be essential for sampling **Barker** and **Campbell (1981), McSorely** and **Parrado (1982), Noe, Barker** and **Schmitt (1981)** and **Davis (1984)** also attempted to the negative binomial distribution to the nemic frequency distribution. The parameter K of the negative binomial has been used as an index of aggregation with the assumption that small values are related to the physical size of clusters in a field **(Pielou 1977), Taylor, Woiwood** and **Perry (1979)** have considered that K. is not a suitable index of aggregation, as it is not related to the spatial pattern. **Alby Ferris** and **Ferris (1983)** have observed that the index of dispersion **(Id)** increases in value as population becomes less highly dispersed and more patchy or clumped and Id for a plot does not change as long as the areas of high and low population levels within a plot retain the same relative numbers of organisms, even though the absolute numbers may change. The distinct nature of the patches result in bimodality, which makes frequency distribution a poor fit when all the plots are considered together. **Tarjon (1964)** studied the distribution of plant parasitic nematodes of Citrus and other crops in Puertorico. Among the 18 genera of plant parasitic nematodes reported *Helicotylenchus, Meloidogyne, Rotylenchulus reniformis, Tylenchus, Tylenchorhynchus* and *Xiphinima* were most commonalty encounter. **Griffin** and **Darting (1964)** have shown that *Xiphinema americanum*

has two-population peak per session in ornamental spruce nurseries. **Kirpatrick et. al. (1964)** has explained that many plant nematodes show a preference for feeding or penetration at particular zones on the root and at specific stages in the roots ontogeny. **Loof (1964)** collected free living and plant parasitic nematodes from Venezuela. **Zuekerman et. al. (1964)** studied population dynamics of nematodes in cranberry soils.

The correlation and regression analysis of population area more meaningful than range and mean values intensity and distribution maps frequency and distribution density are frequently used tools in nematodes ecology. But the frequency value has biological meaning only in relation to the particular size and shape of sampling area used **(Ferris 1985 a). Andrassy (1956)** proposed the formula for the computation of nematode biomass that is most widely used in spite of the criticism that body length and maximum body diameter of a nematode are influenced by certain rr ecgical factors. However, biomass appears to provide a good picture of energy flow in union with frequency and density **(Waliullah1983).**

Prasad and **Chawla (1965)** and **Chong et. al. (1965)** conducted preliminary survey in various plants of India..They correlated the Citrus die back symptoms with *Tylenchulus semipenetrans* populations **Edward et. al. (1965)** reported the population fluctuations of plant parasitic nematodes in 5 different species of Citrus. They found that there are increase in population in March and April. Maximum number of parasitic nematodes was found associated with Jambheri fallowed by Karha and Mosambi. **Edward et.al. (1965)** reported qualitative and quantitative studies on plant parasitic nematodes associated with rhizospheres of some Citrus plants.

Curtis (1959) suggested the concept importance value by combining relative frequency relative density and density and relative abundance. **Norton (1978)** suggested the use of relative biomass instead of relative dominance in measuring importance value. The nematode ecologists to compare energy transfer by fungivorous, Herbivorous, fee living and plant parasitic nematodes in an undisturbed

ecosystem have extensively used **Norton's importance value**. **Samathanum** and **Chawla (1981), Mukherji** and **Dasgupta (1982,1983 b) and Ray and Parija (1985)** have published a few papers on nematode community analysis in India. Impotence values does not appear to be a good measure of relative pathogenic significance of a species in a polyspecific community for which other indexes are called for. **Rama** and **Dasgupta (1986)** have proposed a ranking a pathogenic significance on the basis of pathogenicity. Pathogenic history and relative weight age of ecological parameters like prominence value, relative frequency relative density and relative dominance in that order. Such ranking can be useful for multivariate analysis for data sets without more well founded quantifications.

Oostenbrink (1966) described major characteristics of the relations between nematodes and plants. **Cohn (1966)** found that in Israel, there was no correlation between Citrus nematode fluctuations and seasonal changes in soil temperature. **Benerji** and

range tests can then be used to identify significant differences between means of treatments although it is usually possible to arrive at significant F statistical, provide enough replicates are used, the important part of the analysis of variance is not the F test but the relative sizes of mean squares that indicate the relative contributions to variance of the components in the analysis of variance model **(Wallace1983).**

Ferris et. al. (1967) studied population dynamics of nematodes in fields planted to soyabeans and crops grown in rotation with Soyabean **Swaroop et. al. (1967)** studied the plant parasitic nematodes genus *Rotylenchulus* in India.

Crop loss in a field is hardly ever due to a single cause. Determinants of crop loss have ignored this complexity in the past. **Wallace (1873,1983)** first illustrated the utilization of multivariate analysis in reducing the complex data on a multitude of stresses to identify the most critical determents among them in causing crop yield loss, some limitations to the multiple regression analysis as tools have been visualized in respect of interactions between independent variables **(Finney 1972)**, number of factors being to exceed three including a nematode **(Wallace 1983),** supposed influence of external conditions **(Seinhorst,1918a)** and difficult to interpret factorial experiments **(Wallace1983), O. Banon (1968)** indicated two periods of rise and fall in the Citrus nematode populations in Florida . The highest population was recorded between April to January and minimum in October to December. **Flegg (1968)** studied occurrence and distribution of *Xiphinema* and *Longidorus* in South Eastern England. **Mukhopadhyaya** and **Prasad (1968)** investigated the effect of seasons on the population dynamics of *Tylenchorhynchus.* **Sethi** and **Swaroop (1968)** studied plant parasitic nematodes of North Western India.

The interactions between mineral component of the nutrition of the host plant and phytonematodes have received. Scant attention **(Tarjan1950, Shands** and **Crittenden 1957**.**Griffin** and **Darling 1964, Kirpatrick, Mai, Parker** and **Fischer 1841, Banage** and **Vissir 1965, Soreczan 1969, Willis 1972, Ismail** and **Saxena 1976, Norton 1978,**

Malik and **Jairajpuri 1984, Dwivedi, Malhotra** and **Mishra 1985, Dwivedi, Malhotra, Mishra** and **Sukla (1986a).** Those studying the influence of nematodes on host nutrition have frequently observed the presence of above normal concentrations of macronutrients in root knot nematode in infected roots. **Bessey (1911)** observed that addition of Potassium enabled infected plants to produce a good crop in spite of the nematode. **Oteifa (1951)** showed that or position of *Meloidogyne* ·*incognita* increased with the addition of Potassium with the nutrient solution. **Oteifa (1953)** demonstrated that the rate of development of *M. incognita* in roots of lima beans was restarted at low levels of Potassium and accelerated at high levels **Dropkin** and **Kings (1956)** reported reduced absorption and translocation of P^{32} in galls Vs. healthy roots. **Hunter (1958)** found that 5-week-old root knot infections had no effect on P^{32} translocation, but reported that at low nutrient levels infected roots observed less P^{32} than healthy roots. He also reported that N, P, Mg, and K were in higher concentrations in infected than in healthy roots. **Shafie** and **Jenkins (1963)** reported increase of potassium (K), Nitrogen (N), Phosphorus (P), and Sodium (Na), ranging from 150 to 266% in Pepper roots infected with *M. incognita* aerita **Chitwood 1949**. However concentrations of these minerals in the ·foliage remained unchanged. **Maung** and **Jenkins (1959)** obtained similar results with N, P and K in root knot infected tomato. **Oteifa** and **Elgindi (1962)** reported that tomato roots infected for 3 months with *M. Javanica*. **Chitwood 1949** observed P^{32} as a faster rate than healthy roots by the rate of translocation of P^{32} from roots to foliage was only 39% of that of healthy roots. **Marks** and **Sayre (1964)** studied the effects of K nutrition of a host plant on the role of development of 3 roots knot nematode species. **Bergeson (1966)** demonstrated that excesses of N and K in the roots of Tomato infected with *M. incognita* are primarily due to metabolic upsets in which these minerals are mobilized to the infection site. Excesses due to the failure of infected roots to translocate the minerals of other plants parts appeared to be slight. **Singh** and **Sitaramaiah (1973)** reported reduction in root knot ·intensity and increase in yield in okra and tomato with some suitable

fertilizers combination. **Haque, Khan** and **Saxena (1974)** have determined the effects of different dose of K on root knot of brinjal, which showed that with increasing doses of K root knot index decreased but host growth was maximum at the medium dose. **Sen** and **Das Gupta (1982)** suggested implementation of suitable nutrient management programme as part of integrated pest management to regulate nemic density. Recently **Hagvar (1987)** experimentally demonstrated that in the most common forest type of Norway (Spruce with Blueberry in the field layer), species of Protozoa, Rotatoria, Nematoda and Enchytracidae were generally reduced in abundance by both raised and reduced soil pH. The nutrients, supply, plant development and nematode multiplication were found to take an analogous course in the experimental investigations conducted by **Stelter and Effmert (1987).**

Brezeski (1969) found that the distribution of nematodes in cabbage fields in Poland was most closely related to pH and independent of soil type. **Cohn (1969)** described that the smaller species occur in the heavier soil where as in the lighter soil nematodes of greater body volume are more abundant. **Edward .et. al. (1969)** reported the association of *Pratylenchus* with *Chrysanthemum* root in India and named the nematode P. chrysanthus. **Khuntia** and **Das (1969)** reported plant parasitic nematodes associated with fruit trees in Orrissa. **Krishna et. al. (1969)** studied vertical distribution pattern of plant parasitic nematodes in tobacco fields in Mysore. **Prasad** and **Jha (1969)** recorded 9 genera, namely Tylenchorhynchus, *Hoplolaimus, Helicotylenchus, Meloidogyne, Hirschmaniella, Dorylaimus, Mononchus, Rhabditis* and *Descolaimus.* They suggested that soil moisture, aeration, temperature, maneuvering and vegetation are important factors affecting the population of Nematodes in Bihar **Richter (1969)** found that *Trichodorus* occurred in greater number in the deeper soil layers compared with species of *Tylenchorhynchus* and *Pratylenchus.*

Literature records not much published reports on the influence of nemic infections on amino acid content of infected plants. **Hanounik**

and **Osborne (1975)** reported that 16 amino acids including the precursors for nicotine, and nicotine were greater in infected (Mc. Nair 30) than in healthy roots of the resistant N.C. 95 tobacco variety. Nematode infections apparently increased amino acid precursors for nicotine, which in turn seemed to have stimulated more nicotine formation through an unknown mechanism.

Edward et.al. (1970) studied the plant parasitic nematodes associated with hill orange (*Citrus reticulata* blanco) in Sikkim. **Dao (1970)** demonstrated the marked selective influence of climatic factors especially temperature on the composition of the nematode fauna. Thus the main influence on the population changes of nematodes recorded up to now is apparently induced by food (Plant), temperature and moisture. **Yadav et al. (1970)** surveyed the plant parasitic nematodes associated with fruit trees in Rajasthan.

The literature on chemical properties of soils in India includes published work of **Sharma, Banerjee** and **Singhal (1985), Singh, Nath, Pal** and **Banerjee (1985), Yadav** and **Sharma (1985), Pandit, Chawla** and **Rao (1988)** believed that the effects of soil communities on soil properties will be marked on the soil developed from the same parent rock having same slope and topography. Roots take up biochemical constituents from a large volume of soil materials and concentrate them into biomass. Letter transfers much of this biomass beneath the canopy, where decomposition releases the basophilic chemical constituents to the soil.

Edward et. al. (1970) studied the plant parasitic nematodes associated with hill orange (*Citrus reticulata* blanco). The population of *Tylenchulus semipenetrans* in soil and roots is correlated with the stage of decline of the trees was studied by **Reynolds** and **O' Banon (1963), Swaroop et. al. (1964), Chona et. al. (1965), Bindra et. al. (1967), Manjraker** and **Talgeri (1969)** and **Mukhopadhyay** and **Saran (1970)**.The highest population density occurred during August **(Prasad** and **Chawla 1965)** April **(Edward et. al. 1965)** and the lowest during January **(Edward et. al1965)** and February **(Prasad** and **Chawla1965), Seinhorst (1956), Lewis** and **Mai (1960), Wallace (1961,1962), Sayre**

and **Mountain(1962), Webster (1864), Hoff** and **Mai(1964), Koen(1966), O. Banon (1968), Tseng et al. (1968), Miyagawa** and **Lear (1970)** and **Yeast (1972)** studies season's impact on the population dynamics of plant parasitic nematodes .

Dalton (1962), Kable and **Mai (1968)** observed the influence of soil moisture on plant parasitic nematodes.

Dalton (1961), Grundbacher et. al. (1962), Lawnsbery (1963), Overman (1965), Ser and **Bell (1965), Fled Masser et. al. (1965), Griffin (1966,1969), Davide (1967), Fliegel** and **Golden (1968), Lampberti (1969), Laughlin (1969), Evans (1969), Cotton et. al. (1970)** studied the influence of soil temperature on the population dynamics of plant parasitic nematodes.

Khan, Adhami and **Saxena (1971)** studies population changes in relation to soil temperature and moisture of *Hoplolaimus, Hemicreconemoides* and *Helicotylenchus* around mango roots in U.P. **Ferris et. al. (1971)** used two mathematical methods, a resemblance equation and community ordination in soyabeans soils in Indiana and Illinois. **Norton (1971)** studied soil factors were correlated with number of selected species of nematodes from 40-soyabean fields over two years in Jawa. The soil factors studied were pH silt and clay, percent organic matter. **Olthof (1971)** showed the populations were low in the summer and high in the autumn, although seasonal changes were not consistent from year to year. **Franklin (1971)** studied population dynamic of *Meloidogyne noasi* in the field. **Ahmad (1971)** studied some host records of parasitic leaf nematodes.

Blake (1972) reported *Helicotylenchus multicinctus* as causing organism of extensive root necrosis die back and dysfunction leading eventually to disability of entire plant in west Bengal. **Saxena et.al. (1972)** studied the ecology and vertical distribution of *Helicotylenchus elegans*. **O. Banon (1972)** studied population fluctuation of 3 parasitic nematodes in Florida Citrus. **Good (1972)** reported that small grain crops like barley are helpful in reducing the population densities of root knot nematodes .He also reported that the root knot nematodes increased on cotton. **Siddiqui et.al. (1972)** reported the occurrence of

Tylenchorynchus brassicae in different district of U.P.and Host range of this nematode.

Abivarde (1978) reported stylet-bearing nematodes *Tylenchorynchus cylindricus*. **Cobb (1914)** studied the common Guava *Psidium guajava* L. in Iran. **Rashid et. al. (1973)** surveyed the nematodes associated with vegetables, fruits, cereals and other crops in North India. **Siddiqui et. al (1973)** studied effect of temperature and moisture on multiplication of *Tylenchorynchus brassicae* at 0-15 cm, 16-30 cm, 31-45 cm, and 46-60 cm, depth around cauliflower and cabbage. **Knobloch et.al (1973)** collected various plant parasitic nematodes from Maxico.

Mukhopadhyaya and **Haque (1974)** studied nematodes associated with field crops, fruits and fodder crops in West Bengal. **Pereira** and **Santosh (1974)** studied seasonal changes in the numbers and stages of *Ditylenchchus dipsaci* **(Kuhn),** Filipjev in soil and host plants (Zeamays and *Phaseolus vulgaris*) in Portugal. **Lane** and **Withcher (1974)** recorded sixteen genera of Stylet bearing nematodes in 13 forest soils in the coastal plains of South Carolina near George Town. The most commonly occurring genera were *Aphelenchus creconemoides*, *Helecotylenchus,* *Hoplolaimus,* *Tylenchus,* *Tylenchorhynchus*, and *Xiphinema*. **Singh** and **Mishra (1974)** surveyed plant parasitic nematodes associated with sugarcane in seventeen can growing districts representing foothills (Tarai) Western, Central and Eastern regions of U.P. and recorded 40 species comprising of 21 genera *Hoplolaimus, Helicotylenchus, Tylenchorhynchus, Pratylenchus, Tylenchus, Hemicreconemoides* and *Xiphinema* were the commonly occurring the nematodes.

Brodie and **Murphy (1975)** studied population dynamics of plant nematodes affected by combinations of follow and cropping sequence. **Edward et. al. (1975)** noted an increase in phytonematodes population during November to April in irrigated vegetable and Citrus soil where as unirrigated soil showed a rise in population of nematodes in the month of July to September. **Winstow (1975)** studied some aspects of the ecology of free living and plant parasitic nematodes. **Raman** and

Rao (1975) recorded lance nematodes (*Hoplolaimus indicus*) in association with over 30 species of crop plants including rise under different soil conditions.

Brodie (1976) studied vertical distribution of 3 nematodes species in relation to certain solid properties at 0-15 cm, 15- 30 cm, 30-45 cm, 45cm -60cm, 60-75cm, 75-90 cm and 90-105 cm around Tifton, Georgia. **Ismail (1976)** studied the development of root-knot nematode in relation to different levels of Potassium and N, P, K status on Tomato, *Lycopersicum ecopersicum* and **Ferris et. al. (1976)** studied spatial distribution of nematodes in Peach orchards. **Gill** and **Sharma (1976)** studied additional hosts of the foliar nematode *Aphelenchoides ritzemabosi* from India. **Willis et. al. (1976)** studied the species of plant parasitic nematodes associated with forage crops in eastern Canada. **Lal** and **Yadav** studied the effect of soil salinity on the occurrence of phytoparasitic nematodes.

Mousa et. al. (1977) reported *Helicotylenchus, Hemicreconemoides, Hoplolaimus, Rotylenchulus, Xiphinema, Tylenchorhynchus* and *Tylenchus* associated with grape cines in Egypt at 0-60 cm depth vertically. **Taha** and **Sultan (1977)** observed the max. concentration of Citrus nematode larvae in citrus root zone in top 30 cm soil column, 30 cm away from tree trunk irrespective of the age and growth variation in the trees, and drastic population reduction below 30 cm depth. **Baghel et. al. (1977)** reported *Helicotylenchus multicinctus* on Banana. **Bajaj et. al. (1977)** described statistical analysis of variability in a population of *Xiphinema basiri* **Siddiqui (1959). Gill et. al. (1977)** reported pathogenic effect of *Tylenchorhynchus vulgaris* on gram and plant and Potato Cultivation.

Coates, Beckford and **Malek (1978)** studied host preferences of the stunt nematode *Tylenchorhynchus agri.* **Chabra (1978)** studied distribution pattern of *Tylenchulus semipenetrans* population and determination of suitable distance and depth for soil sampling. **Norton (1978)** reported the effect of soil moisture on plant parasitic nematodes. **Thomas (1978)** studied the population densities of

nematode under seven village regimes. **Walliullah (1978)** studied statistical analysis on *Hemicreconemoides mangiferae*.

Loff and **Sharma (1979)** studied plant parasitic nematodes from Bahia state, Brazil. **Das** and **Mohanty (1979)** studied the occurrence and host preferences of some plant parasitic nematodes on pulse crops.

Malik (1980) studied population responses to temperature in the sub family Tylenchorhynchinae and observed that optimum temperature of 30^0C was most suitable for increasing population in all soils. **Gaur** and **Prasad (1980)** studied population dynamics of *Meloidogyne incognita*.

Chawla and **Prasad (1973), Khan et. al. (1975-76), Alam et. al. (1976-77)** investigated the influence of crop rotation on population dynamics of plant parasitic nematodes. **Sivapalan (1972)** and **Khera** and **Chaturvedi (1977)** studied 35 nematode species associated with tea mainly from North East India. **Sitaramaiha et.al. (1971), Rajendran et. al. (1979), Mohandas** and **Prabhoo (1979), Mukhopadhyay** and **Haque (1974), Mukherjee** and **Dasgupta (1981)** reported *Helicotylenchus, Hoplolaimus,and Rotylenchulus, Tylenchorhynchus* associated with banana plants from West Bengal. **Rebois (1968,78), Golden et.al. (1978), Ralph et. al. (1974)** and **Robert (1982)** studied the nematodes associated with soybean field and its effect on yields.

Ferris (1970), Wallace (1970), Mamiya (1971), Gupta and **Atwal (1971), Slack et. al. (1972), Upadhyay** and **Swaroop (1972), Hung et.al. (1972), Bird (1972), Kimpinski (1971,76), Miller** and **Rich (1974), Sutherland** and **Sluggett (1974), Griffin (1980)** and **Zirakparvar et. al. (1980)** studied the influence of temperature on the population dynamics of plant parasitic nematodes. **Ferris et.al. (1974), Johnson (1974), Lucas et al. (1978), Harris (1979), Muthukrishnan** and **Sunderbabu (1979)** and **Hussain (1981)** studied the impact of seasonal variations on the population dynamics of the plant parasitic nematodes **Gill (1974,75,77)** studied nematode infection in potato.

Mc. Sorely et. al. (1981) reported plant parasitic nematodes associated with mango in relation to tree condition. They reported

Rotylenchulus reniformis, Hemicreconemoides mangiferae and *Helicotylenchus* around mango trees at 0-15 cm depth. **Mukherji** and **Dasgupta (1981)** recorded plant parasitic nematodes belonging to 15 genera in different agro ecological tracks of West Bengal India. **Mishra** and **Das (1981)** studied distribution and population dynamics of nematodes in rice field and pasture land in India at 0-15 cm and 15-30 cm depth. **Sharma et. al (1981)** determined the appropriate sampling distance for as certain nematodes density and infestation on citrus tress of varying ages viz.2-3 years,5-6 years and 10-15 years in two citrus.

Mc. Gawley and **Chapman (1982)** studied population dynamics of Criconemoides simile in Soya bean. **Mukherji** and **Gupta (1982)** studied community analysis of plant parasitic nematodes in tea plantation of west Bengal, India. The commonly recorded genera were *Helicotylenchus, Hemicreconemoides* and *Xiphinema* etc. **Haque** and **Mukhopadhyaya (1982)** studied the effect of soil moisture and soil salinity on the infectivity of *Rotylenchulus reniformis* on castor. **Bafokuzara (1982)** identified plant parasitic nematodes occurring on Pineapples in Uganda and determine their frequency of occurrence and distribution. **Mc. Sorely** and **Parrado (1982)** estimated mean population of plant parasitic nematode in groves of four tropical tree crops in South Florida viz. Guava (*Psidium guajava*), Avocado (*Persea americana*) Mango (*Mangifera Indica*) and Tahiti lime (*Citrus* 'x' Tahiti) and recorded *Helecotylenchus, Hemicreconemaoides mangifereae, Rotylenchlus reniformis* and *Tylenchulus semipenetrans.* **Singh** and **Khera (1982)** studied seasonal fluctuation of *H. Dubius* and of other Tylenchid nematodes. **Baghel** and **Bhatti (1982)** determined the optimum time for occurrence of peak population of the Citrus nematodes at horizontal and vertical distances, which could help in contemplating an effective control measure and drawing soil root samples for nematode assay. **Lindsay et.al. (1982)** studied the influence of initial population densities of *Meloidogyne incognita* on 3 Chile cultivators. **Somathanum** and **Chawla (1982)** studied the plant parasitic nematodes of Hill areas of Southern districts of Tamilnadu. **Al.**

Hazmi (1982) studied population dynamics of *Meloidogyne incognita* on corn grown in soil infested with *Arthrobotrys cenoides*.

Nugyen and **Khoung (1983)** estimated plant parasitic .nematodes from more than 1700 soil and plant samples collected from eight province of South Vietnam 9 genera viz. *Helicotylenchus, Creconemoides, Meloidogyne, Pratylenchus, Tylenchorhynchus, Hoplolaimus, Hirschmanniella, Xiphinema* and *Rotylenchulus* were recorded. **Remon georgis et.al (1983)** studied vertical distribution of *Heterorhabditis bactereophora* and H. *heliothidis* in sandy loam soil. **Mukherjee** and **Das Gupta (1983)** studied the frequency of occurrence population density and prominence values of all the species encountered from a community analysis. **Alby et. al. (1983)** studied dispersion and distribution of *Pratylenchus seripheri* and *H. galeatus* in Soyabean fields. **Anderson (1983)** studied morphological characters of *Hoplolaimus indicus* on wild rice. **George et.al. (1983)** studied population development of *Pratylenchus hexincisus* in eight corns in .breads. **Heyns** and **Coomans (1983)** studied 3 *Xiphinema* species from papaya. **Kimpinsky et. al. (1983)** studied the frequency of plant parasitic nematodes associated with Blue gram and western wheat grass in the western Dakotas.

Malek and **Jairajpuri (1984)** reported the effect of pH and some mineral salts and fatty acid on survival of *Xiphinema americanum*. **Davis (1984)** studied distribution of *Tylenchulus semipenetrans* in a Taxas grape fruit orchard.

Jones (1980), Malek (1980), Johnson et.al. (1981), Kimpinsky and **Willis (1981), Roberts et. al. (1981), Santo and O. Banon (1981), Anderson (1982)** and **Carter et. al. (1982)** studied the effect of temperature on the population dynamics of plant parasitic nematodes. **Hulton** (1978) and **Das et. al. (1982)** studied the impact of soil moisture on the distribution of plant parasitic nematodes. **Singh** and **Khan (1981)** and **Haque** and **Mukhopadhyay (1982)** studied the effect of soil factors on the nematodes.

L. Hanel 1993, 1996 studied the diversity of soil nematodes in various types of ecosystems, soil nematodes in a meadow-spruce

forest ecotone, comparison of soil nematode communities. **L. Hanel** also studied soil nematodes in forest ecosystems and composition & seasonal changes in soil nematode community in 1996, **L. Hanel 1997** defines vertical distribution of soil nematode diversity. **J.A. Amador 1997** studied the soil form follows function. Effect of carbon amendment and soil moisture in *Hoplolaimus galeatus* and *Tylenchorhyncus* sp. studied by **M.C. Browning, S. R. Dawson, C.F. Alm, Mc Elderry** & **J.A. Amador** in **1999**. Identification is a prerequisite to an understanding of the effect of nematodes as parasites of plants. It is obvious that no significant study on plant pests should be initiated until the identity of the parasite has been accurately established. A new description of the process of the identification of plant parasitic Nematodes given by **Renaud Fortuner 1989. David S. Wisong** & **Eric D. Kerr 1997** give the guideline to help in root and soil analysis in corn and also described ring Nematode, stunt Nematode and lance Nematodes. Inter relationship between cyst Nematodes and K. R. Barker and E. C. Mc Gawley 1998 describe other microorganism. **C. Overstreet** and **E. C. Mc Gawly 1998** propose current research with *Rotylenchus reniformes* in Louisiana. **S. B. Sharma** and **Y. L. Nene 1999** have studied the effects of soil solarization on Nematodes parasitic to chickpea and pigeinpea. **G. W. Lawrence, K. S. Mclean** & **J. R. Barillas 1990, 1991** first report of *Hoplolaimus magnistylus* in Mississippi and also studied the Nematode management and Pathogenicity of the lence Nematode, *Hoplolaimus magnistylus*.

D.A. Neher, T. R. Weicht, M.C. Savin, J.H. Gorres & **J. A. Amador 1999** studied the grassing in a porous environment and proposed a nematode community structure for plant & soils. **M. J. Fuller** studies moisture measurement in Mississippi in 1991. **Z. A. Handoo** & **A. M. Golden 1992** suggested a key and diagnostic compendium to the species of *Hoplolaimus daday* 1905. In Idaho & Eastern Oregon plant parasitic nematode associated with crop is studied by **S. L. Hafiz, A. M. Golden, F. Rashid** & **Z. Handoo** in 1992. Occurrence, population density and distribution of *Pratylenchus* species in Oman studied by **A. Mani, M. S. Al Hinai** & **Z. A. Handoo**

1998. In species of the *Tylenchorhynchus* **Cobb 1913, Z. A. Handoo 2000** gives a diagnostic compendium with key. **S. B. Sharma** & **Y. L. Nene 1998** studied the effect of *Hoplolaimus seinhorsti* on pigeinpea biomass. Nematodes identification even limited to the genus level is a difficult prosess, which is not mustered by all plant nematologists **(R. Fortuner 1998)**.

CHAPTER 3

MATERIAL & METHODS

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MATERIAL & METHODOLOGY

Extraction of plant Nematodes from the rhizosphere soils of important fruit plants and preparation of glycerin mounts of desirable Nematode, the methods used in the present study were divided into following steps-

A. Site selection

B. Soil sampling, extraction, counting storage and processing of Phytonematodes.

C. Permanent microscopic preparation, mounting and identification of Phytonematodes.

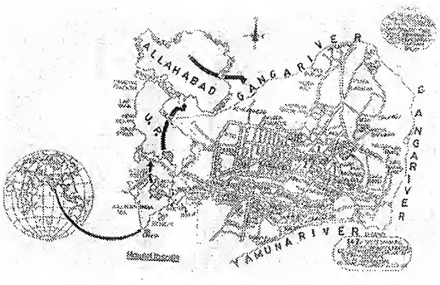
D. Statistical analysis.

SITE SELECTION

The investigations were carried out primarily at two different places of Gangatic planes situated at 100 m ASL in Allahabad .The area of the district is occupied with the economically valuable forestation, plantations and fruit crops. The soil type of the district varies with different places. Site first is *Roxburg* Garden of Botany Department, University of Allahabad. Distance of the site first from the Parasitology Laboratory of Department of Zoology is nearly 100 mts.

The second site, *Alfred* Park, Allahabad, U.P, India situated at the confluence of holy rivers Ganga and Yamuna at 25' 28" Latitude and 81' 54" Longitude. The locality of collection in *Alfred* park (Company Garden) area is some 1.5 km away from the department of Zoology of Allahabad University. This Park has extensive fruit plantations of various kinds. The soil type of area is clay loam. The altitudes of collection sites were gauged by Altimeter.

This investigation presents an account of various genera of nematodes and its population associated with important fruit crops viz. *Psidium guajava, Zizyphus jujuba,* and *Carrica papaya* in relation to various edaphic factors.



SOIL SAMPLING, EXTRACTION, COUNTING, STORAGE AND PROCESSING OF PHYTONEMATODES

Sampling: Fortnightly collections of soil samples were made around the root zone of *Psidium guajava, Zyzyphus jujuba* and *Carica papaya.* Each sample consisted of three sub samples collected from 0 - 10 cm, 10.1 - 20 cm and 20.1 - 30 cm vertical depths at distance of 0 - 10 cm, 10.1 - 20 cm and 20.1 - 30 cm from collar region of plants under natural condition during month June 1997 to May 1999 with the help of auger having a diameter of 5.5 cm. These samples consisted of 3 sub samples each time. All the samples of particular depth were to be collected from various sites in Allahabad with the help of necessary equipments were carried to the site of collection.

Storage: All the soil samples of particular depth were stored separately in polythene bags and labeled properly. The idea behind storing the samples in polythene bags was to prevent loss of moisture from the soil during the period of examination in the laboratory. The collected soil samples were normally analyzed and examined within a day or two as for as possible. When large number of soil samples were collected and the examination of the samples were not possible within a day or two after collection, such samples were stored in polythene

bags at 5 -10^0 C without damage to the nematode population for a period of at least one week.

Extraction: The method used for the extraction of nematodes from soil samples varied with the number of sample to be analyzed and the type of nematode expected. This is evident by preliminary surveys conducted in the area. The various methods used for this were proposed during present investigation. The methods consisted of a series of steps. At each step soil particle heavier then nematodes setting to the bottom more quickly were discarded and upper lighter fraction containing floating nematodes were collected on sieves. 250 ml and 500ml soil was taken for extraction of nematodes. The soil was placed in a bucket, covered with water and thoroughly agitated to obtain homogeneous suspension. The nematode being lighter floated in the upper portion of the suspension. The suspension was allowed to stand undisturbed for a brief period to allow the heavier sand particles to settle down to the bottom. The nematodes being lighter as compared to the sand occupied the upper portion of suspension. The supernatant suspension was passed through the sieves beginning with 60 mesh followed by 100 mesh, 200 mesh and 300 mesh in succession. The deposit at the bottom of the pail containing the sand and other substances were discarded at each step.

The residues on 100, 200 and 300 mesh sieves contained the majority of plant parasitic nematodes viz. *Hoplolaimus, Helicotylenchus, Paratylenchus, Dolychorhynchus, Tylenchorhynchus* and other forms of 1-1.15 mm, 0.5-1 mm and 0.20-0.50 mm dimensions respectively. The residues were washed and transferred to a single beaker. The latter contained much of the organic debris, root bits, saprophytic forms and larger nematodes such as parasitic *Dorylamids*. Where as that from the 60 mesh sieves was transferred to another beaker.

The residues from 100, 200 and 300 sieves mesh were collected and nematodes were extracted by the **Baermann's funnel method**, where as that from 60 mesh was directly examined under the dissecting microscope.

Cobb's shifting and Gravitation method: The principle of .shifting and gravitation was applied to settle down heavy sand particles and discard them for separating nematodes from soil samples brought to laboratory. The lighter fraction containing nematodes are passed through a set of four sieves with 60, 100, 200, 300 pores per linear 2.5 cm to separate the nematode from the muddy solution. By this method large quantity of soil samples could be analysed and there for loss of a few during the process of extraction did not affect the findings. Metal sieves with 60, 100, 200 and 300 pores per linear 2.5 cm have been recommended in the Cobb's method coupled with **Baermann's techniques**. Mobility formed the chief base in extraction of nematodes from soil and roots. The details are given below:

The variations recommended by **Perry** include the washing of soils by shifting and gravitational method. The screen resides were .collected in the beaker in about 100 ml water. The composed screenings were placed in a 250 ml beaker and a 15cm square piece of moderately closed mesh muslin was wetted and fastened over top with a rubber band. This beaker was then inverted into 15cm. funnel partly filled with water. The nematodes begin to work out through cloth and settle to the bottom of the tube within few minutes. Even the slow moving nematodes were collected by this method by allowing the sample to stand overnight. The size of the mesh may be adjusted depending on whether large nematodes are held back of particles of trash also pass through along with the nematodes.

Oostenbrink (1960) and **Seinhorst (1962)** recommend a quicker and efficient method by using cotton wool filter supported by flat screen in a dish with a shallow layer of water just touching the filter paper. The .residues were placed over the cotton wool filter.

The sample to be placed on the filter might be:

(a) The residues caught on the sieve by the sieving technique of **Christae** and **Perry (1951 b)**

(b) An etutriation process **Oosteinbrink 1960, Seinhorst (1962)**

(c) Nematodes bearing sediments from a different sedimentation process **(Taylor 1936, Dalmasso 1966).**

Cobb's method was used when only a few samples had to be examined. However **Baermann's funnel method** was used to work with larger number of samples and the nematodes thus collected were free from dust particles and organic debris. 250 – 500 ml soil was taken for extraction of phytonematodes. The soil was placed in a bucket, covered with water and thoroughly agitated to obtain a homogeneous suspension. The suspension was allowed to stand undisturbed for a brief period of 30 seconds to allow the heavier sand particles to settle down at the bottom. The nematodes being lighter occupied upper portion of the suspension. The supernatant suspension was passed through the sieves beginning with 60 mesh followed by 100,200 and 300 mesh. The unwanted materials such as sand particles, stones, plant roots etc. were discarded and the residue of 100,200 and 300 sieve mesh contained majority of plant parasitic nematodes viz. *Hoplolaimus indicus, Helicotylenchus indicus, Hemicreconemoides mangiferae, Tylenchorhynchus brevileneatus* and other forms of less dimensions from 1.5-2.0 mm. These residues were washed and transferred to a 250 ml beaker. This nematode suspension poured on to a wire gauze sieve that was fixed on a beaker and contained two layers of tissue paper holding sufficient water to remain in contact with bottom of the wire gauze. The residue collected in beaker was finally subjected to quantitative and qualitative analysis in aliquots of 10 ml in counting disorder the dissecting microscope.

Baermann's Funnel Method: Baermann's (1917) method was another good method for the extraction of nematodes from soil but has certain basic differences from **Cobb's method**. The principle of **Baermann's funnel method** is based on the principal that nematodes moves towards water from an environment subjected to desiccation. By this method only actively moving nematodes can be extracted. This however, is not suitable to extract the dead nematodes, which fail to emerge through the filter, and the forms that are slow moving take longer time to keep sample ready for examination. The basic requirement in this method is of a funnel of 10-15 cm diameter; to the stem of a rubber tubing (clamped by a pinch cock) is attached. The

whole assembly rests on a wooden stand. The funnel was filled with water in which the sample contained in a cloth bag was lowered and allowed to remain for some time ranging from a few hours to several days based on the types of nematodes. The nematodes were drawn off in a clean dry beaker from the funnel by opening the pinchcock. Water drawn off; is free from dirt and other undesirable substances. A clean suspension containing nematodes was necessary for population study. Generally a large majority of the active nematodes could be extracted if the sample is left overnight.

Following precautions were taken to ensure maximum collection of nematodes by this method:

- Soil lumps were broken mechanically yet lightly and the whole mass was agitated briskly in water to release nematodes in the suspension.
- The sediments obtained after passing the suspension through a sieve was again agitated with water before sieving twice.
- Residue collected over sieve was transferred to the beaker quickly to avoid drying of nematodes.
- As for as possible the soil sample was processed within 24 hours to avoid drying of nematodes.

The **Baermann's** method proved an excellent method for separating nematodes from the screen residue and condensing them for examination **Christie** and **Perry (1951)** recommended the use of a blender to release the endoparasitic nematodes from plant materials. **Christie** and **Perry (1951)** and **Oosteinbrink (1956).** has suggested a modification of this method.

Baermann's funnel method (1912), Cobb's method (1918) modified **Baermann's method** recommended by **Christie** and **Perry (1951)** and centrifugation techniques of **Caveness** and **Jenson (1955)** with **Miller's** modification **(1957)** had been employed according to need in the present study. Actual accounts of these nematodes are presented.

Centrifugal Floatation Technique (Caveness and Jensen 1955): The floatation of phytonematodes by the use of sugar solution of

greater specific gravity (1:18) then that of nematode (1:05) can be used when greater numbers of nematodes are required. To prepare the 'sugar solution of required specific gravity, 484 gms. sugar is dissolved in one liter of water. Further processing is done on following lines-

- The nematodes suspension is obtained in the beaker by sieving method.
- The contents of the beaker are poured into centrifuge tubes distributing the content equally among the two.
- Add water if required to bring the level equal.
- Centrifuge the contents at 300 rpm for 4 minutes.
- Nematodes and debris will settle down at the bottom of the centrifuge tube. The supernatant is carefully discarded.
- Fill each tube half full with the sugar solution. Add 10 ml of 10% lactic acid to the sugar solution to inhibit bacterial growth then stopped the tube with a rubber stopper and shake well.
- Remove the rubber stopper and fill tubes with sugar solution.
- Centrifuge again at 3000 rpm for two minutes.
- The nematodes and debris of the equal gravity will float in the supernatant. The nematodes are removed by decanting the supernatant suspension through 300 meshes.
- To remove the sugar solution washes the residue on the sieve very gently.
- Transfer these content into a 250 ml beaker.

Precaution: The processing of these nematodes techniques must be as fast as possible as after addition of sugar solution. The nematodes should not be left in it for longer periods.

This is one of the quickest method to extract the nematode free from undesirable substances present in the soil the method is based an floatation nematodes in sugar solution of higher specific gravity **Miller (1957)** suggested passing the solution containing nematodes through a 300-325 sieve mesh and passing this method too has a limitation as at a time only 100-125 ml of soil at a time can be processed.

To overcome this short coming in the present study 250-500 ml of soil was dissolved in water, allowed to stand momentarily and

passed through 60 mesh sieve for supernatant out undesirable contaminants and heavier soil particle by the screen.

The mixture passing through the sieve was collected in a beaker and processed by the centrifugation method of **Jenson (1955)** with the modifications suggested by **Miller (1957)** described above. This procedure is capable of extracting nematode population even from small quantity of soil. This method was extensively used in the current study when the number of samples was more and required to be examined without much loss of time.

Counting of phytonematodes: To estimate the population of various phytonematodes, 250 ml soil was processed. The liquid obtained from any one of the above-mentioned techniques containing nematodes was reduced to 10 ml by screening the filtrate over 300 meshes or in a counting dish. The counting of different types of the nematodes was done under 10x10 magnification of the binocular. To minimize the counting errors two readings of each samples were taken and average density of nematodes was took.

PERMANENT MOUNTING AND IDENTIFCATION OF NEMATODES:

A. Killing and fixation: Whenever necessary for identification purposes the nematodes were killed and processed for making suitable mount for permanent preparation for microscopial examination. Nematodes extracted from the soil were analysed quantitatively and qualitatively and were preserved for future examination by permanent mounting of the phytonematodes. These were picked up with the help of a fine niddle mounted on a wooden holder. The nematode was killed with hot fixative to prevent twisting and contraction. These were than fixed with in the fixative for about 48 hours. To study the nature of oesophagus and other structures, the colder fixatives gave better results the following fixatives gave better performance then others-

(i) P.A. 4:1 (Seinhorst, 1966)

Formalin (40%)	4 ml
Glacial acetic acid	1 ml
Distilled water	95 ml

(ii) F.A.G.10:1:1 (Degrisse 1965)

Formalin (40%)	10 ml
Glacial acetic acid	1 ml
Glycerin	1 ml
Distilled water	88 ml

Or in other words when ever necessary for identification purposes the nematodes were killed and processed for making suitable preparation for microscopial examination. The steps evolved in the process are in detailed that nematodes extracted from soil were manually picked up with the help of a fine niddle mounted on a plastic or wooden holder and placed in small 20 mm diameter cavity blocks filled with water. The nematodes were killed by pouring hot (70-80%) fixative over them. Care was taken to avoid excess heating the fixative was cooled to room temperature and excess of water taken out with the help of a fine tipped dropper. The worms were fixed in the fixative for at least 48 hours. However the use of cold fixative gave better result to study the nature of oesophagus and other structures. The fixatives used in the present studies were those, recommended by **Seinhorst (1960)** or **De Grisse (1965).** However **De Grisse** methods was found to be more satisfactory and convenient, as the nematodes need not to be transferred from one fixative to another. The composition of the fixative suggested by **Seinhorst (1966)** and **De Grisse (1965)** were as above killing by hot fixative distortion avoid for twisting facilitating better microscopic examinations of minute structures like lateral pores, phasmid etc. when mounted in glycerin. **De Grisse's** fixative provided excellent view of organs of the nematodes viz. oesophagus, intestine, reproductive organs which are of great taxonomic value. The temperature of fixative was raised to 70-80^{0}C by direct heating before applying to nematodes collected in a small quantity of water in small cavity block. The nematode may be stored in the fixative without any adverse effects for months together.

The nematodes may fixed, may be dehydrated for semi-permanent mounting by the methods of **Seinhorst (1959,62,66)** or that of **De Grisse (1965).** However **De Grisse's** method was mostly

followed in the present investigation as it was found to be more satisfactory and convenient over that of **Seinhorst.** The procedure for making glycerin mounts by the two methods are given below:

Seinhorst method for making Glycerin mounts:

The various steps followed were as follows-

(a) Previously killed nematodes were transferred to 4% Formalin in a cavity block and fixed for 8-12 hours preferably overnight.

(b) After fixation the nematodes were transferred to a mixture of ethanol (96%) glycerin and the distilled water in the ratio of (20:1:79). The cavity block was covered with a lid or cover slip (24x24 mm) and placed in a desiccators (saturated with ethanol vapor) kept in an incubator at $40^0 \pm 1^0C$ for about 12 hours preferably overnight.

(c) The Cavity block was taken out of the desiccators after 12 hours. The liquid from the cavity block was drawn out to the maximum and replaced with a mixture of ethanol (96%) and glycerin in the ratio of 93:7 and covered with a glass cover and transferred in the incubator at 40^0C for 2-3 hours. There after a drop of pure glycerin was added twice to the cavity block after every one hour. The cavity block was inversely covered with cover glass and placed in the incubator at 40^0C for another 2-3 hours it was then transferred into the desiccators containing calcium chloride and left there over night. The nematodes were ready for mounting in pure glycerin.

De Grisse's method for making Glycerin Mount:

1. The collected nematodes were fixed in De Grisse's fixative for 48 hours (recommended 3-4 days) in a Cavity block.
2. The fixative was reduced to 1ml with the help of finally drawn pipette and kept at 40^0C in the ethanol atmosphere for 6 to 8 hours.
3. The cavity block was removed from ethanol atmosphere and fixative no. 2 and the following composition were added till the

cavity block was completely filled - Ethanol **(96%)** 95ml, Glycerin 5ml.

4. The Cavity block was covered and placed in the incubator at 40^0C for 2-3 hours.
5. The lid of the cavity block was removed after 2-3 hours and the solution containing nematodes allowed to evaporate for a one hour.
6. It was replaced with another fixative no.3 **(Seinhorst 1962)** and the following composition was added ethanol 96%-50 ml, Glycerin 50ml.
7. The cavity block was covered and placed in an incubator at 40^0C for 1-2 hours.
8. After 1-2 hours the lid of the cavity block was removed and the solution allowed evaporating at 40^0C for nearly 2 hrs.
9. Finally the cavity block is placed in a desiccators containing $Cacl_2$ and left overnight
10. The nematodes were mounted in pure glycerin and sealed with nail polish.

Rapid Lectophenol Method for Mounting of Nematode: (Franklin and Goodey 1949)

It was very often necessary to make nematode mounts available for microscopic examination within a short period of time after extraction. The only alternative was to use lactophenol. The formula of which is-

Liquid phenol (Colorless)-		94ml
Lactic acid	-	83ml
Glycerol	-	160ml
Distilled water	-	100ml

The nematode were first fixed in F.A.4:1, Then they were transferred to lactophenol and heated to 60^0 C, cooled and mounted in a drop of lactophenol on a aluminum slide.

Franklin and **Goodey** recommended the use of 25% cotton blue lactophenol in place of pure lactophenol. Further great care had to be

exercised with lactophenol cotton blue to prevent over staining and once the nematodes were over stained it was difficult to destain them.

Preparation of enface view of head and cross section of nematode:

The position and morphology of lip structures are of considerable taxonomic importance.

The glycerin jelly used for taking the enface view sections of nematodes was prepared as follows. I am of gelatin was socked in 40 ml of distilled water for 2 hours. A mixture of 50 gm of glycerin and one gm of phenol was then added to it. The mixture was heated in a water bath for 10-15 minutes and kept till the mixture because homogenous it was later allowed cooling.

Preparation of enface view mounts:

A small bit of glycerin gelatin was placed on a **Perspex** slide (Preferred over the glass slide to save the cutting edges of the scalped) and melted with a hot needle. The nematode, which had been processed to glycerin was placed in the melted jelly with the aid of hand needle the nematode was oriented in an oriented position. The head end of the nematode was orientated in a convenient position. The head end of the nematode was cut at a distance of about 1-2 head with from the anterior end by using a knife made from sharpened steel needle (Oculest scalpel or a piece of razor blade mounted on a bamboo needle can also be used).

The cut head end was transferred on to a small piece of hand gelatin melted over a small flame on a clean glass slide or aluminum slide. An eyelash was placed here the cut headpiece to act as a pointer. There were done under the dissecting microscopic. The cut head end was then manipulated with hand needle so as to make the lip- region point upward 3-4 pieces of thin glass rods, thinner then the cross section of the head were placed on the slide and covered with a round cover slip (18mm) the cover slip was taken so manipulated under the low power of compound microscope that the head end pointed upwards. The cover slip was finally sealed as described earlier.

Preparation of slides:

Light and handy, particularly unbreakable, aluminum double cover slip slides as well as glass slides were used in this studies-

A number of similar nematodes (6-8), of more or less equal diameter were transferred to a small drop of glycerin over 24x24 mm square cover slip on the slide. The nematodes in the glycerin drop were made to lie at the bottom of the glycerin drop with the help of a needle. 3-4 glass rods 0 - 0.25, 0 - 0.5 cm long and almost of the same diameter as that of nematodes were arranged radially in the glycerin drop in order to avoid the pressure of the mounting cover slip (18mm) was placed frequently over the drop. Excess of the glycerin following out of the cover slip allowed to be taken away by small piece of blotting paper placed around the round cover slip.

The cover slip was then fixed at 3 points by applying glycil or cutex with aid of thin (No-1) painting brush. As the point hardened, the cover slip was ringed with glycil. A second containing of glycil was given over the first and allowed today the slide was now ready for labeling and microscopial examination.

Identification of nematodes:

Identification of Phytonematodes was done with the help of keys and was confirmed by Prof. S. L. Mishra, Professor, Department of Zoology, University of Allahabad, Allahabad.

CHAPTER 4

ECOLOGICAL STUDIES

CHAPTER FOUR

ECOLOGICAL STUDIES

The following edaphic factors have been analysed during the study.

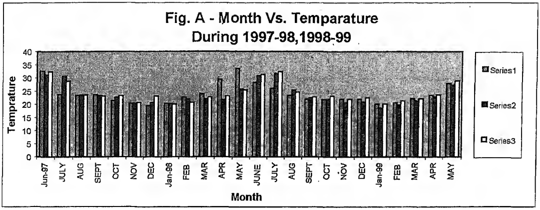
Soil Temperature: The soil temperature was recorded at each vertical depth and distance from the stem of plant / tree with the help of dial thermometer.

Table - A

Month wise Soil temperatures in ^{0}C at 0 to 30 Cm. Vertical depth and 0 to 30 Cm Horizontal distances around the stem of *Psidium guajava*, *Zyzyphus jujuba* and *Carica papaya* during 1997-98 and 1998-99

Month	Temperatures in ^{0}C At Horizontal dist. 0 to 30 cm and vertical depth 0 to 30 cm		
	V = 0 to 10 cm	V = 10.1 to 20 cm	V = 20.1 to 30 cm
Jun 1997	32.7 ^{0}C	31.2 ^{0}C	32.4 ^{0}C
Jul1997	23.8 ^{0}C	30.8 ^{0}C	28.8 ^{0}C
Aug1997	23.5 ^{0}C	23.6 ^{0}C	23.6 ^{0}C
Sep1997	23.8 ^{0}C	23.4 ^{0}C	23.2 ^{0}C
Oct1997	21.5 ^{0}C	22.8 ^{0}C	23.4 ^{0}C
Nov1997	20.4 ^{0}C	20.5 ^{0}C	20.8 ^{0}C
Dec1997	19.6 ^{0}C	20.8 ^{0}C	23.2 ^{0}C
Jan 1998	20.4 ^{0}C	20.4 ^{0}C	20.2 ^{0}C
Feb1998	22.8 ^{0}C	20.0 ^{0}C	20.8 ^{0}C
Mar1998	24.0 ^{0}C	22.0 ^{0}C	22.8 ^{0}C
Apr1998	29.4 ^{0}C	21.7 ^{0}C	23.2 ^{0}C
May1998	33.6 ^{0}C	25.8 ^{0}C	25.4 ^{0}C
Jun1998	28.2 ^{0}C	30.9 ^{0}C	31.3 ^{0}C
Jul1998	26.1 ^{0}C	31.7 ^{0}C	32.4 ^{0}C
Aug1998	23.4 ^{0}C	25.5 ^{0}C	24.6 ^{0}C
Sep1998	22.0 ^{0}C	22.6 ^{0}C	22.8 ^{0}C
Oct1998	21.8 ^{0}C	22.0 ^{0}C	23.2 ^{0}C
Nov1998	21.9 ^{0}C	20.6 ^{0}C	22.0 ^{0}C
Dec1998	22.0 ^{0}C	20.9 ^{0}C	22.6 ^{0}C
Jan1999	20.2 ^{0}C	18.6 ^{0}C	20.2 ^{0}C
Feb1999	20.6 ^{0}C	19.7 ^{0}C	21.4 ^{0}C
Mar1999	22.2 ^{0}C	21.4 ^{0}C	22.2 ^{0}C
Apr1999	23.5 ^{0}C	22.8 ^{0}C	23.6 ^{0}C
May1999	28.0 ^{0}C	27.3 ^{0}C	28.9 ^{0}C

Where; H = Horizontal Distance and V = Vertical Depth



Where; Series 1, Series 2 and Series 3 is Temperature at 3 vertical depths: 0-10.0 cm, 10.1 – 20.0 cm and 20.1 – 30.0 cm respectively and at 0 – 30 cm horizontal distance from the stem of cm ***Psidium guajava, Zyzyphus jujuba*** and ***Carica papaya*** during 1997-98 and 1998-99.

Soil Moisture: The soil moisture was measured on the spot with the help of elico portable moisture meter model DM-33 and was confirmed in the laboratory by dry and wet weight method. The soil samples were collected from the pits formed after removal of monolith. Soil samples from the upper, middle and lower strata were collected and sealed immediately in the Polythene bags and carried to the laboratory for confirmation of soil moisture percentage. Definite quantity of soil samples was weight immediately (for fresh weight) and then dried in an over at 105^0C (for dry weight, **Mishra 1968)**. The moisture percentage was calculated by:

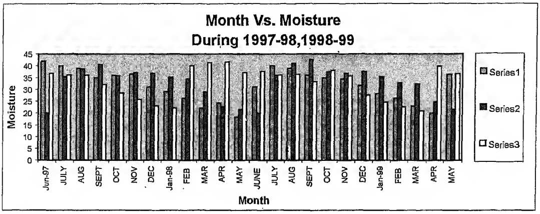
$$\text{Moisture Percentage} = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Dry weight}} \times 100$$

Table - B

Month wise Soil Moisture in % at 0 to 30 Cm. Vertical depth and 0 to 30 Cm Horizontal distances around the stem of *Psidium guajava, Zyzyphus jujuba* and *Carica papaya* during 1997-98 and 1998-99

Month	Moisture in % At Horizontal dist. 0 to 30 cm and vertical depth 0 to 30 cm		
	V = 0 to 10 cm	V = 10.1 to 20 cm	V = 20.1 to 30 cm
Jun 1997	42.0%	20.1%	36.9%
Jul1997	40.0%	35.4%	36.2%
Aug1997	39.0%	38.7%	36.0%
Sep1997	35.0%	40.6%	32.2%
Oct1997	36.0%	35.8%	28.5%
Nov1997	36.6%	37.3%	25.8%
Dec1997	31.0%	36.8%	23.2%
Jan 1998	29.2%	35.2%	22.2%
Feb1998	26.3%	34.5%	40.1%
Mar1998	22.0%	29.0%	41.4%
Apr1998	24.3%	22.8%	41.7%
May1998	18.4%	21.7%	37.2%
Jun1998	31.0%	20.1%	37.8%
Jul1998	40.0%	36.0%	36.2%
Aug1998	39.0%	41.2%	36.4%
Sep1998	36.0%	42.7%	33.3%
Oct1998	35.0%	37.5%	38.0%
Nov1998	34.5%	36.9%	35.8%
Dec1998	31.7%	37.6%	27.7%
Jan1999	28.3%	35.4%	24.6%
Feb1999	26.5%	32.8%	22.7%
Mar1999	23.0%	32.4%	21.0%
Apr1999	20.0%	24.8%	39.8%
May1999	36.4%	21.6%	36.7%

Where; H = Horizontal Distance and V = Vertical Depth



Where; Series 1, Series 2 and Series 3 is Moisture at 3 vertical depths: 0-10.0 cm, 10.1 – 20.0 cm and 20.1 – 30.0 cm respectively and at 0 – 30 cm horizontal distance from the stem of cm ***Psidium guajava, Zyzyphus jujuba*** and ***Carica papaya*** during 1997-98 and 1998-99.

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CHAPTER 5

STATISTICAL ANALYSIS

CHAPTER FIVE

STATISTICAL ANALYSIS

The census count for absolute measurements, it is usual to express population figure in per-square meter or per cubic decimeter. Different workers in this connection have made different methods. **Van Jarasveldon** and **Ryke (1968)** expressed the population density either on area or volume basis. **Edward (1967)** reported the population figures per unit area or volume of soil were commonly used as a measure for the density of soil fauna. Murphy 1955 reported that purely quantitative & qualitative figure gives a very misleading picture and suggested biomass as a relatively more appropriate for this purpose.

Mac Fadyan (1953) recommended areas as most suitable basis for expressing the population density.

The formula for the statistical analysis is as follows:

$$P = \frac{1000 \times n}{V} = \text{No. of individuals in per cubic decimeter (No. / dm}^3\text{)}$$

or

$$P = \frac{1000 \times n}{\pi r^2 h} = \text{No. of individuals in per cubic decimeter (No. / dm}^3\text{)}$$

Where;

P	=	Population
n	=	No. of individuals collected
V	=	Volume of the sampler
r	=	radius of the sampler
h	=	height of the sampler

However the above formula was applied to measure the soil fauna in relation to collembola on volume basis first time by **Chattoraj** and **Bist (1985)**.

POPULATION STRUCTURE

Following formulae were used to analyze the population structure:

Mean Density or Average Density (M.D. or A.D.): Mean density of plant nematodes was calculated as follows:

$$\overline{X} = \frac{\Sigma x}{n} = \frac{X_1 + X_2 + X_3 + \ldots\ldots\ldots\ldots + X_n}{n}$$

Where; X = Mean Density per dm^3

ΣX = Sum of X_1, X_2, X_3, X_n

X_1, X_2, X_3, X_n = Number of Plant nematodes collected from each sample on each occasion.

Percentage Frequency (P. F.):

$$\text{P.F.} = \frac{\text{No. of samples in which species occurred}}{\text{Total no. of samples studied}} \times 100$$

Relative frequency (R. F.):

$$\text{R.F.} = \frac{\text{Frequency of species X}}{\text{Sum of frequencies of all species}} \times 100$$

Relative Density (R. D.):

$$\text{R.D.} = \frac{\text{No. of individuals in a species}}{\text{Total no. of individuals of all species}} \times 100$$

Dominance value index (D.V.I.): A new parameter i.e. Dominance Value Index was formulated and applied for the first time by **Chattoraj** and **Dwivedi (1977).** This parameter intact shows the overall status of a species in its community. Dominance value index was calculated by the following formula:

$$\text{D. V. I.} = \frac{\text{P.F.} + \text{R.F.} + \text{R. D.}}{3}$$

The formula for coefficient of correlation was derived as follows:

$$r = \frac{\Sigma dx\, dy - (-dxdy)/n}{\sqrt{\{\Sigma dx^2 - (\Sigma dx)^2/n\}\{\Sigma dy^2 - (\Sigma dy)^2/n\}}}$$

Where;

	r	=	Coefficient of correlation
	Σdx	=	Sum of deviation of variables (x) from its assumed mean
	Σdy	=	Sum of deviation of the variables (y) from its assumed mean
	n	=	Total number of observations

Regression analysis was also done for population (y) of plant nematodes by considering factors (x). The regression equation was obtained by the following formula:

$$y = a + bx$$

Where;

$$a = \bar{Y} - b\bar{x}$$

and

$$b = \frac{\Sigma xy - (\Sigma x)(\Sigma y)/n}{\Sigma x^2 - (\Sigma x)^2/n}$$

Functional Linear Regression (Snedecor and Cochran, 1968): Regression Analysis was done for population (y) of plant nematode with their corresponding factors (x). Regression as calculated by following formula:

$$Y = \alpha_{yx} + \beta_{yx} \,.\, X$$

Where;

	αyx	=	y- intercept
	βyx	=	slope predicting $\bar{y}$ from $\bar{x}$

$\bar{Y}$ and $\bar{X}$ are the mean of variable Y and X respectively and n is the total number of observations.

The above formula is also known as Regression. Linear Regression of plant nematodes population of each variable separately was fitted. Regression equation is useful for the purpose of predicting (Y) when independent variables are assigned values.

Standard Deviation (S.D.): (Snedecor and Cochran 1968):

$$S.D. = \sigma = \sqrt{\frac{X^2}{n-1}}$$

Where;	x	=	deviation from mean
	n	=	number of samples

Standard Error:(Snedecor and Cochran, 1968):

$$S.E. = \sqrt{\frac{S.D.}{n}}$$

Where;	n	=	no. of samples

Student 's' 't' distribution: (Snedecor and Cochran 1968):

$$t = \frac{r\sqrt{n-1}}{\sqrt{1-r^2}}$$

Where;	r	=	Coefficient of correlation
	n	=	number of samples

Polethetic divisive classificatory system (Malhotra, Dixit and **Kapoor, 1981)** has been applied to establish morphometric differences between the species.

Coefficient of dissimilarity (C.Diss.):

$$C.Diss. = \frac{\sum_{i}^{n} (X_1j - X_2j)}{\sum_{i}^{n} (X_1j + X_2j)}$$

Coefficient of divergence (C.D.):

$$C.D. = 2\,\frac{\overline{m}_1 - \overline{m}_2}{\overline{m}_1 + \overline{m}_2}$$

Mean character differences (M.C.D.):

$$M.C.D. = \frac{1}{n}\sum_{i}^{n}\frac{(X_1j - X_2j)}{X_{max}}$$

Where;	n	=	Number of species
	X_1j	=	Value of the Jth attribute for any pair of species.
	X_2j	=	Value of the Jth attribute for any pair of species.
	m_1	=	Mean value of parameter in two populations of species
	m_2	=	Mean value of parameter in two populations of species
	X_{max}	=	Maximum value assumed by attribute.

CHAPTER 6

RESULT
&
DISCUSSION

CHAPTER
SIX

RESULTS & DISCUSSION

Host Plant: *Psidium guajava*

Species 1: *Hoplolaimus johani*

·EFFECT OF SOIL TEMPERATURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

The population of male *Hoplolaimus johani* decreased around the *Psidium guajava* showing better state significant at the state 0-10cm depths and 0-10cm, 10.1-20.0 cm distance (Table No.1, Fig.No.1&2).

The population of male *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state of 0-10 cm depth and 20.1-30.0 cm distance (Table No. Fig.No.3).

V = 10.1 – 20.0 CM

The population of male *Hoplolaimus johani* decreased around the Psidium guajava showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.1, Fig.No.4, 5&6).

V = 20.1 – 30.0 CM

The population of male *Hoplolaimus johani* is highly increased around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm distance (Table No.1, Fig.No.7).

The population of male *Hoplolaimus johani* is increased around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 10.1-20.0 cm (Table No.1, Fig.No.8).

The population of male *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No.1, Fig.No.9).

B. MALE POPULATION: 1998-99

V = 0 – 10 CM

The population of male *Hoplolaimus johani* decreased around the *Psidium guajava* showing better state significant at the state 0-10cm depth and 0-10cm, 10.1-20.0cm, 20.1-30.0 cm distance (Table No.2, Fig.No.10, 11&12).

V=10.1-20.0 CM

The population of male *Hoplolaimus johani* decreased around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 0-10cm, 20.1-30.0 cm distance (Table No.2, Fig.No.13&15).

The population of male *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No.2, Fig.No.14).

V=20.1-30.0 CM

The population of male *Hoplolaimus johani* is highly increased around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 0-10.cm distance (Table No.2, Fig.No.16).

The population of male *Hoplolaimus johani* is increased around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 20.1-30.0 cm (Table No.2, Fig.No.18).

The population of male *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 20.1-30.0 cm depth and 10.1-20.0cm distance (Table No.2, Fig.No.17).

FEMALE POPULATION

A. FEMALE POPULATION: 1997-98

V = 0 – 10 CM

The population of Female Hoplolaimus johani Declined around the Psidium guajava showing better state significant at the state 0-10cm depth and 0-10cm, 20.1-30.0 cm distance (Table No.1,. Fig.No.1&3).The population of Female Hoplolaimus johani around the Psidium guajava is not significant at the state 0-10.0cm depth and 10.1-20.0 cm distance (Table No.1, Fig.No.2).

V=10.1-20.0 CM

The population of Female *Hoplolaimus johani* decreased around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.1, Fig. No. 4, 5&6).

V=20.1-30.0 CM

The population of Female *Hoplolaimus johani* decreased around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 0-10cm, 10.1-20.0 cm distance (Table No.1, Fig.No.7& 8).

The population of Female *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state of 20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No.1, Fig.No.9).

B. FEMALE POPULATION: 1998-99

V = 0 – 10 CM

The population of Female *Hoplolaimus johani* declined around the *Psidium guajava* showing better state significant at the state 0-10.0 cm depth and 0-10 cm, 10.1-20.0 cm, distance (Table No.2, Fig.No.10&11).

The population of Female *Hoplolaimus johani* increased around the *Psidium guajava* showing better state significant at the state 0-10.0 cm depth and 20.1-30.0 cm distance (Table No.2, Fig.No.12).

V=10.1-20.0 CM

The population of Female *Hoplolaimus johani* declined around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm distance (Table No.2, Fig.No.13).

The population of Female *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 1.0-20.0 cm depth and 10.1-20.0cm, 20.1-30.0 cm distance (Table No.2, Fig.No.14&15).

V=20.1-30.0 CM

The population of Female *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 20.1-30.0 cm depth and 0-10cm, 10.1-20.0 cm distance (Table No.2, Fig.No.16& 17).

The population of Female *Hoplolaimus johani* increased around the *Psidium guajava* showing better state significant at the state20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No.2, Fig.No.18).

LARVA POPULATION

A. LARVA POPULATION: 1997-98

V = 0 – 10 CM

The Larva population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 0-10 cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.1, Fig.No.1, 2&3).

V=10.1-20.0 CM

The Larva population of *Hoplolaimus johani* declined around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm distance (Table No.1, Fig.No.4 & 5).

The Larva population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 10.1- 20.0 cm depth and, 20.1-30.0 cm distance (Table No.1, Fig.No.6).

V=20.1-30.0 CM

The Larva population of *Hoplolaimus johani* declined around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.1, Fig.No.7, 8&9).

B. LARVA POPULATION: 1998-99

V = 0 – 10 CM

The Larva population of *Hoplolaimus johani* declined around the *Psidium guajava* showing better state significant at the state 0-10 cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No.2,Fig.No.10&12).

The Larva population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 0-10 cm depth and, 10.1-20.0 cm distance (Table No.2, Fig.No.11).

V=10.1-20.0 CM

The Larva population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 10.1-20.0 cm depth and 0-10cm, 10.1-20.0 cm distance (Table No.2, Fig.No.13 & 14).

The Larva population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 10.1- 20.0 cm depth and, 20.1-30.0 cm distance (Table No.2, Fig.No.15).

V=20.1-30.0 CMS

The Larva population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 20.1-30.0 cm depth and 0-10 cm, distance (Table No.2, Fig.No.16).

The Larva population of *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 20.1- 30.0 cm depth and 10.1-20.0cm, 20.1-30.0 cm distance (Table No.2, Fig.No.17&18).

TOTAL POPULATION

A. TOTAL POPULATION: 1997-98

V = 0 – 10 CM

Total population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 0-10 cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.1, Fig.No.1, 2&3).

V=10.1-20.0CM

Total population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 10.1-20.0 cm depth and 0-10cm, 10.1-20.0 cm distance (Table No.1, Fig.No.4&5).

Total population of *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 10.1- 20.0 cm depth and 20.1-30.0cm distance (Table No.1, Fig.No.6).

V=20.1-30.0CM

Total population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 20.1- 30.0 cm depth and 0-10 cm distance (Table No.1, Fig.No.7).

Total population of *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 20.1- 30.0 cm depth and 10.1-20.0cm, 20.1-30.0 cm distance (Table No.1, Fig.No.8 &9).

B. TOTAL POPULATION: 1998-99

V = 0 – 10 CM

Total population of *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 0-10cm, 10.1-20.0cm, distance (Table No.2, Fig.No.10&11).

Total population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 0-10 cm depth and 20.1-30.0 cm distance (Table No.2, Fig.No.12).

V=10.1-20.0CM

Total population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 10.1-20.0 cm depth and 0-10cm, 10.1-20.0 cm distance (Table No.2, Fig.No.13&14).

Total population of *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 20.1-30.0cm distance (Table No.2, Fig.No.15).

V=20.1-30.0CM

Total population of *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 20.1-30.0 cm depth and 0-10cm, 20.1-30.0 cm distance (Table No.2, Fig.No.16&18).

Total population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0cm depth and 10.1-20.0 cm distance (Table No.2, Fig.No.17).

In the present study total nematode population including parasitic and saprophytic separately showed inverse relationship with soil temperature at 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm vertical depths during the period of study June 1997- May 1999, but a few exceptions where also shown the linear regression trend indicate that the population of male decreases with increase of soil temperature at 0-10 cm and 10.1-20.0 cm at vertical depths, but showing positive

relationship with soil temperature at 20.1-30.0 cm vertical depths during 1997-98 and 1998-99. The female population decline with increase of soil temperature it means showed inverse relationship with soil temperature at all the depths (0-10 cm,. 10.1-20.0 cm & 20.1-30.0 cm) during both year of study, but during 1998-99 at 20.1-30.0 cm vertical depth and 20.1-30.0 cm horizontal distance it showed positive relationship with soil temperature. Larva and total nematode population also showed the inverse relationship with soil temperature during both the year of study and at all vertical depths but larva at 10.1-20.0 cm vertical depth and 20.1-30.0 cm horizontal distance showed positive relationship with soil temperature and the total population at the stage of 20.1-30.0 cm vertical depth and 10.1-20.0 cm horizontal distance also showed positive relationship with soil temperature. (Table no. 1 & 2, fig. No. 1 - 18)

Ross 1962, Thorne 1968, Norton 1978, Zirakparvar 1980 and **Mallik 1980** reported that temperature around 30 ± 1^0C found to be the most suitable for the reproduction of active nematode. The role of temperature as a major factor limiting nematode population has been stressed by **Norton 1978**, it has been argued that extremes of temperature may be inhibitory for the moderate temperature. The present study was in total conformity with the above findings.

EFFECT OF SOIL MOISTURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

Population of male *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 0-10 cm distance (Table No.3, Fig.No.1).

Population of male *Hoplolaimus johani* around the *Psidium guajava* is not significant at the state 0-10.0 cm depth and 10.1-20.0 cm distance (Table No. 3, Fig.No.2).

Population of male *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 20.1-30.0cm distance (Table No.3, Fig.No.3).

V=10.1-20.0 CM.

Population of male *Hoplolaimus johani* highly increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm distance (Table No.3, Fig.No.4 .).

Population of male *Hoplolaimus johani* increased around the *Psidium guajava* showing better s significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.3, Fig.No.5&6).

V=20.1-30.0 CM

Population of male *Hoplolaimus johani* highly increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm distance (Table No.3, Fig.No.7).

Population of male *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.3, Fig.No.8&9).

B. Male Population: 1998-99

V = 0 – 10 CM

The population of male *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 0-10 cm, 10.1-20.0 cm distance (Table No.4, Fig.No.10&11, Series 1.).

Population of male *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 20.1-30.0cm distance (Table No.4, Fig.No.12).

V=10.1-20.0 CM

Population of male *Hoplolaimus johani* highly increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm. distance (Table No.4, Fig.No.13&14).

Population of male *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 20.1-30.0 cm distance (Table No.4, Fig.No.15).

V=20.1-30.0 CM

Population of male *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm distance (Table No.4, Fig.No.16).

Population of male *Hoplolaimus johani* declined around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.4, Fig.No.17&18).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

Population of Female *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10cm, 10.1-20.0 cm.20.1-30.0cm distance (Table No.3, Fig.No.1, 2&3).

V=10.1-20.0 CM

Population of Female *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm distance (Table No.3, Fig.No.4).

Population of Female *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 3, Fig.No.5&6).

V=20.1-30.0 CM

The population of female *Hoplolaimus johani* is not significant at the state of 20.1-30.0 cm depth and 0-10cm distance (Table No.3, Fig.No.7).

Population of Female *Hoplolaimus johani* highly increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 20.1-30.0 cm distance (Table No.3, Fig.No.9).

Population of Female *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm distance (Table No.3, Fig.No.8).

B. Female Population: 1998-99

V = 0 – 10 CM

The population of female *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 10.1-20.0 cm distance (Table No.4, Fig.No.11).

Population of female *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 20.1-30.0 cm distance (Table No.4, Fig.No.10&12,).

V=10.1-20.0 CM

Population of female *Hoplolaimus johani* highly increased around the *Psidium guajavava o ing signi i an a h s a m d p h and m dis an* (Table No.4, Fig.No.13).

Population of female *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.4, Fig.No.14&15).

V=20.1-30.0 CM

Population of female *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 20.1-30.0 cm distance (Table No.4, Fig.No.16&18).

Population of female *Hoplolaimus johani* declined around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm distance (Table No.4, Fig.No.17).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

Population of Larva of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10cm distance (Table No.3, Fig.No.1).

Population of Larva of *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 10.1-20.0 cm distance (Table No.3, Fig.No.2).

The Larva population of *Hoplolaimus johani* is not significant at the state of 0-10 cm depth and 20.1-30.0 cm distance (Table No.3, Fig.No.3).

V=10.1-20.0 CM

Population of Larva of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.3, Fig.No.4, 5&6).

V=20.1-30.0 CM

The population of Larva of *Hoplolaimus johani* is not significant at the state of 20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No.3, Fig.No.9)

Population of Larva of *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10 cm distance (Table No.3,. Fig.No.7).

Population of Larva of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm distance (Table No.3, Fig.No.8).

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 10.1-20.0 cm distance (Table No.4, Fig.No.11).

The Larva population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 20.1-30.0 cm distance (Table No.4, Fig.No.10&12).

V=10.1-20.0 CM

The Larva population of *Hoplolaimus johani* highly increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm distance (Table No.4, Fig.No.13).

The Larva population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.4, Fig.No.14&15).

V=20.1-30.0 CM

The Larva population of *Hoplolaimus johani* declined around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.4, Fig.No.16, 17&18).

TL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM

Total Population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.3, Fig.No.1, 2&3).

V=10.1-20.0 CM

Total population of *Hoplolaimus johani* is not significant at the state of 10.1-20.0 cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No.3, Fig No.4&6).

Total Population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm distance (Table No.3, Fig.No.5).

V=20.1-30.0 CM

Total Population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.3, Fig.No.7,8 &9).

B. Total Population: 1998-99

V = 0 – 10 CM

Total Population of *Hoplolaimus johani* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 10.1-20.0 cm distance (Table No.4, Fig.No.11).

Total Population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 20.1-30.0 cm distance (Table No.4, Fig.No.10&12).

V=10.1-20.0 CM

Total Population of *Hoplolaimus johani* highly increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm distance (Table No.4, Fig.No.13).

Total Population of *Hoplolaimus johani* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.4, Fig.No.14&15).

V=20.1-30.0 CM

Total Population of *Hoplolaimus johani* declined around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.4, Fig.No.16,17 &18).

Population has not shown high infection prevalence (particularly). The population at 0-10 cm and 10.1-20.0 cm has shown better infection prevalence in moisture in compression to temperature. The month wise high range shows peak population.

The present study showed positive correlation of male, female, larva and total population (parasitic) with soil moisture. The linear regression trends clearly indicate that the population of total, male, female and larva increased with increase of soil moisture levels (Table

No. 3 & 4, Figure No. 1-18). Which is in the conformity of the findings of **Prasad** & **Jha (1960)** and **Rai (1965)**. Linear regression trends clearly indicate positive correlation with soil moisture at all 3 vertical depths and in both years but few exceptions were also shown during this study that in male population of 1997-98 the stage of 0-10 cm vertical depth and horizontal distance and in 1998-99 the stage of 0-10 cm vertical depth & 0-10 cm, 10.1-20.0 cm horizontal distance, 20.1-30.0 cm vertical depth & 10.1-20.0 cm, 20.1-30.0 cm horizontal distances showed inverse relationship with soil moisture. In female population the stage of 10.1-20.0 cm vertical depth & 10.1-20.0 cm, 20.1-30.0 cm horizontal distances during 1997-98 and at the stage of 0 cm vertical depths & 10.1-20.0 cm horizontal distance, 20.1-30.0 cm vertical depth & 10.1-20.0 cm horizontal distance during 1998-99 showed inverse relationship with soil moisture. In the present study larva population of 0-10 cm vertical depths & 10.1-20.0 cm horizontal distance, 20.1-30.0 cm vertical depth & 0-10 cm horizontal distance during 1997-98 and 0-10 cm vertical depth & 10.1-20.0 cm horizontal distance, 20.1-30.0 cm vertical depth at all 3 distances during 1998-99 showed inverse relationship with soil moisture. Total population showed positive relationship with soil moisture during 1997-98 & 1998-99 but during 1998-99 stage of 0-10 cm vertical depth & 10.1 to 20.0 cm distance, 20.1-30.0 cm vertical depth & all 3 dispenses showed inverse relationship with soil moisture the observations of this study is quite in agreement with the findings of **Jone's 1959, Prasad** and **Jha 1969, Khan et. al. 1971** and **Siddiqui et. al. 1972.**

Species 2: *Dolicorhynchus allahabadensis*

EFFECT OF SOIL TEMPERATURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

The population of male *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better state significant at the state 0-10cm depth and 0-10cm, 20.1-30.0 cm distance (Table No.5, Fig.No.19&21).

The population of male *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state of 0-10 cm depth and 10.1-20.0 cm distance (Table No.5, Fig.No.20).

V=10.1-20.0CM

The population of male *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm distance (Table No.5, Fig.No.22).

The population of male *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state of 10.1-20.0cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.5, Fig.No.23&24).

V=20.1-30.0 CM

The population of male *Dolicorhynchus allahabadensis* is highly increased around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No.5, Fig.No.25&27).

The population of male *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state 20.1-30.0 cm depth and 10.1-20.0 cm distance (Table No.5, Fig.No.26).

B. Male Population: 1998-99

V = 0 – 10 CM

The population of male *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better state significant

at the state 0-10cm depth and 0-10cm, 10.1-20.0 cm distance (Table No.6, Fig.No.28&29, Series 1).

The population of male *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better state significant at the state 0-10cm depth and 20.1-30.0 cm distance (Table No.6, Fig.No.30).

V=10.1-20.0 CM

The population of male *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm distance (Table No.6, Fig.No.31).

The population of male *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No.6, Fig.No.32).

The population of male *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 20.1-30.0 cm distance (Table No.6, Fig.No.33).

V=20.1-00.0 CM

The population of male *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state 20.1-30.0 cm depth and 0-10 cm distance (Table No.6, Fig.No.34).

The population of male *Dolicorhynchus allahabadensis* is increased around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 10.1-20.0cm, 20.1-30.0 cm (Table No.6, Fig No.35&36).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

The population of Female *Dolicorhynchus allahabadensis* Declined around the *Psidium guajava* showing better state significant at the state 0-10cm depth and 0-10cm, 20.1-30.0 cm distance (Table No.5, Fig.No.19&21).

The population of Female *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state 0-10.0 cm depth and 10.1-20.0 cm distance (Table No.5, Fig.No.20).

V=10.1-20.0 CM

The population of Female *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No.5, Fig.No.22&24).

The population of Female *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No.5, Fig.No.23).

V=20.1-30.0 CM

The population of Female *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm distance (Table No.5, Fig.No.25).

The population of Female *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state of 20.1-30.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.5, Fig.No.26&27,).

B. Female Population: 1998-99

V = 0 – 10 CM

The population of Female *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state of 0-10 cm depth and 0-10cm, 10.1-20.0 cm distance (Table No.6, Fig.No.28&29).

The population of Female *Dolicorhynchus allahabadensis* declined around the *Psidium guajava* showing better state significant at the state 0-10.0 cm depth and 20.1-30.0 cm, distance (Table No.6, Fig.No.30,).

V=10.1-20.0 CM

The population of Female *Dolicorhynchus allahabadensis* declined around the *Psidium guajava* showing better state significant at

the state 10.1-20.0 cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No.6, Fig.No.31 &33).

The population of Female *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No.6, Fig.No.32).

V=20.1-30.0 CM

The population of Female *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better state significant at the state20.1-30.0 cm depth and 0-10 cm distance (Table No.6, Fig.No.34).

The population of Female *Dolicorhynchus allahabadensis* declined around the *Psidium guajava* showing better state significant at the state 20.1-30.0 cm depth and 10.1-20.0 cm distance (Table No.6, Fig.No.35).

The population of Female *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better state significant at the state20.1-30.0 cm depth and 20.1-30.0 cm dm disce (Table No.6, Fig.No.36).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* declined around the *Psidium guajava* showing better state significant at the state 0-10 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.1 cm distance (Table No.5, Fig.No.19, 20&21).

V=10.1-20.0 CM

The Larva population of *Dolicorhynchus allahabadensis* declined around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, distance (Table No.5, Fig.No.22).

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better significant at the

state 10.1- 20.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.5, Fig.No.23&24).

V=20.1-30.0 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better significant at the state 20.1- 30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.5, Fig.No.25, 26&27).

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* declined around the *Psidium guajava* showing better state significant at the state 0-10 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 6, Fig.No.28, 29&30).

V=10.1-20.0 CM

The Larva population of *Dolicorhynchus allahabadensis* declined around the *Psidium guajava* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm distance (Table No.6, Fig.No.31).

The Larva population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 10.1- 20.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.6, Fig.No.32&33).

V=20.1-30.0 CM

The Larva population of *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state 20.1-30.0 cm depth and 0-10 cm distance (Table No.6, Fig.No.34).

The Larva population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 20.1- 30.0 cm depth and 10.1-20.0cm distance (Table No.6, Fig.No.35).

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm depth and 20.1-30.0cm distance (Table No.6, Fig.No.36).

TOTAL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM : -

Total population of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 0-10 cm depth and 0-10 cm, 10.1- 20.0 cm, 20.1-30.0cm distance (Table No.5, Fig.No.19, 20&21).

V=10.1-20.0CM

Total population of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 0-10 cm depth and 0-10 cm, 20.1-30.0cm distance (Table No.5, Fig.No.22&24).

Total population of *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No.5, Fig.No.23).

V=20.1-30.0CM

Total populat of *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state 20.1-30.0 cm depth and 0-10 cm distance (Table No.5, Fig.No.25).

Total population of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 20.1- 30.0 cm depth and 10.1-20.0cm, 20.1-30.0cm distance (Table No.5, Fig.No.26&27).

B. Total Population: 1998-99

V = 0 – 10 CM

Total population of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 0-10 cm, 10.1-20.0cm, 20.1-30.0 cm distance (Table No.6, Fig.No.28, 29&30).

V=10.1-20.0CM

Total population of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 10.1-20.0cm depth and 0-10 cm distance (Table No.6, Fig.No.31).

Total population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0cm depth and 10.1-20.0cm, 20.1-30.0 cm distance (Table No.6, Fig.No.32&33).

V=20.1-30.0CM

Total population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0cm depth and 0-10cm, 10.1-20.0 cm distance (Table No.6, Fig.No.34 & 35).

Total population of *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better significant at the state 20.1-30.0cm depth and 20.1-30.0cm distance (Table No.6, Fig.No.36).

In the present study the total nematode population showed inverse relationship with soil temperature but some exceptions i.e. few stages of male, female, larva and total population showed positive relationship with soil temperature (Table No. 5,6 Figure 19-36). The present investigation was in total conformity with the findings **Thorne1968, Norton 1978, Zirak paravar 1980, Khan et. al. 1971** and **Pereira** and **Santosh 1974.**

EFFECT OF SOIL MOISTURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

Population of male *Dolicorhynchus allahabadensis* around the *Psidium guajava* is not significant at the state 0-10.0 cm depth and 0-10 cm distance (Table No.7, Fig.No.19).

Population of male *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 0-

10.0cm depth and 10.1-20.0 cm, 20.1-30.0cm distance (Table No.7, Fig.No.20&21).

V=10.1-20.0 CM

Population of male *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm distance (Table No.7, Fig.No.22&23).

Population of male *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better Significant at the state 10.1-20.0 cm.depth and 20.1-30.0 cm distance (Table No.7, Fig.No.24).

V=20.1-30.0 CM

Population of male *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better Significant at the state 20.1-30.0 cm.depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.7, Fig.No.25, 26&27).

B. Male Population: 1998-99

V = 0 – 10 CM

The population of male *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.8, Fig.No.28, 29&30).

V=10.1-20.0 CM

Population of male *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0 cm, 10.1-20.0 cm. distance (Table No.8, Fig.No.31&32).

Population of male *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 20.1-30.0 cm distance (Table No.8, Fig.No.33).

V=20.1-30.0 CM

Population of male *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm distance (Table No.8, Fig.No.34).

Population of male *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better Significant at the state 20.1-30.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.8, Fig.No.35&36).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

Population of Female *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10cm, 20.1-30.0 cm distance (Table No.7, Fig.No.19&21).

Population of Female *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showi owing etter significant at the state 0-10.0cm depth and 10.1-20.0cm distance (Table No.7, Fig.No.20).

V=10.1-20.0 CM

Population of Female *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm distance (Table No.7, Fig.No.22 .).

Population of Female *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.7, Fig.No.23&24).

V=20.1-30.0 CM

Population of Female *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm depth and 0-10.cm distance (Table No.7, Fig.No.25).

The population of female *Dolicorhynchus allahabadensis* is not significant at the state of 20.1-30.0 cm depth and 10.1-20.0 cm distance (Table No.7, Fig.No.26).

Population of Female *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No.7, Fig.No.27).

B. Female Population: 1998-99

V = 0 – 10 CM

The population of female *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 10.1-20.0 cm distance (Table No.8, Fig.No.29).

Population of female *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10.0cm distance (Table No.8, Fig.No.28).

Population of female *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 20.1-30.0 cm distance (Table No.8, Fig.No.21).

V=10.1-20.0 CM

Population of female *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.8, Fig.No.31, 32&33).

V=20.1-30.0 CM

Population of female *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.8, Fig.No.34, 35&36).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

Population of Larva of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better Significant at the state 0-10.0 cm depth and 0-10 cm distance (Table No.7, Fig.No.19, Series 3.).

Population of Larva of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better Significant at the state 0-10.0 cm depth and 20.1-30.0 cm distance (Table No.7, Fig.No.21,).

The Larva population of *Dolicorhynchus allahabadensis* is not significant at the state of 0-10 cm depth and 10.1-30.0 cm distance (Table No.7, Fig.No.20).

V=10.1-20.0 CM

Population of Larva of *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better Significant at the state 10.1-20.0 cm depth and 0-10.0cm, 20.1-30.0 cm distance (Table No.7, Fig.No.22&24).

Population of Larva of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better Significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No.7, Fig.No.23).

V=20.1-30.0 CM

The population of Larva of *Dolicorhynchus allahabadensis* is not significant at the state of 20.1-30.0 cm depth and 10.1-20.0 cm distance (Table No.7, Fig.No.26).

Population of Larva of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better Significant at the state 20.1-30.0 cm depth and 0-10 cm distance (Table No. 7, Fig.No.25).

Population of Larva of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better Significant at the state 20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No.7, Fig.No.27).

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 0-10cm depth and 20.1-30.0 cm distance (Table No.8, Fig.No.30).

The Larva population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10.0 cm, 10.1-20.0 cm distance (Table No.8, Fig.No.28&29).

V=10.1-20.0 CM

The Larva population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.8, Fig.No.31, 32&33 &33)(1U

V=20.1-30.0 CM

The Larva population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better Significant at the state 20.1-30.0 cm depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.8, Fig.No.34, 35&36).

TOTAL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM

Total Population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10cm, 20.1-30.0 cm distance (Table No. 7, Fig. No.19 & 21).

Total population of *Dolicorhynchus allahabadensis* is not significant at the state of 0-10 cm depth and 10.1-20.0 cm distance (Table No. 7, fig No.20)

V=10.1-20.0 CM

Total population of *Dolicorhynchus allahabadensis* is not significant at the state of 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No. 7, fig No.23)

Total Population of *Dolicorhynchus allahabadensis* highly increased around the *Psidium guajava* showing better Significant at the state 10.1-20.0 cm. depth and 0-10 cm distance (Table No. 7, Fig. No.22).

Total Population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better Significant at the state 10.1-20.0 cm. depth and 20.1-30.0 cm distance (Table No. 7, Fig. No.24).

V=20.1-30.0 CM

Total Population of *Dolicorhynchus allahabadensis* decreased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10 cm, 10.1-20.0 cm distance (Table No. 7, Fig. No.25 & 26).

Total Population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 20.1-30.0 cm distance (Table No. 7, Fig. No.27).

B. Total Population: 1998-99

V=0–10CM

Total Population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 8, Fig. No.28, 29 & 30).

V=10.1-20.0 CM

Total Population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 8, Fig. No.31,32 & 33).

V=20.1-30.0 CM

Total Population of *Dolicorhynchus allahabadensis* increased around the *Psidium guajava* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 8, Fig. No.34, 35 & 36).

Population distribution has showed wide variations in relation with temperature. It correlation with temperature was not consistence particularly at 0-10 cm and 10.1-20.0 cm depths.

In the present investigation male, female, larva and total nematode population of above species showed positive relationship with soil moisture but in few stages it showed inverse relationship during both the years (Table No. 7 & 8, Figure 19-36). **Jone's 1959, Prasad** and **Jha 1969, Khan et. al. 1971, Siddiqui et. al. 1972, Rai 1985** that is in total agreement with the present study.

Host Plant: *Zyzyphus jujuba*

Species 1: *Hoplolaimus johani*

EFFECT OF SOIL TEMPERATURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

The population of male *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better state significant at the state 0-10cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No 9, Fig. No.38 &39)

The population of male *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state of 0-10 cm depth and 0-10 cm distance (Table No. 9 Fig. No.37)

V=10.1-20.0CM

The population of male *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state of 10.1-20.0 cm depth and 0-10 cm distance (Table No. 9 Fig. No.40).

The population of male *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.9 Fig. No.41 & 42).

V=20.1-30.0 CM

The population of male *Hoplolaimus johani* is decreased around the *Zyzyphus jujuba*_showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.9, Fig. No.43,44 & 45).

B. Male Population: 1998-99

V = 0 – 10 CM

The population of male *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state of 0-10 cm depth and 0-10 cm distance (Table No. 10 Fig. No.).

The population of male *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better state significant at the state 0-10cm depth and 10.1-20.0cm distance (Table No.10, Fig. No.).

The population of male *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10cm depth and 20.1-30.0 cm distance (Table No.10, Fig. No.48).

V=10.1-20.0 CM

The population of male *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 .cm depth and 0-10cm distance (Table No.10, Fig. No.49).

The population of male *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.10, Fig. No.50 & 51).

V=20.1-30.0 CM

The population of male *Hoplolaimus johani* is highly increased around the *Zyzyphus jujuba* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.10, Fig. No.52,53 & 54).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

The population of Female *Hoplolaimus johani* Declined around the *Zyzyphus jujuba* showing better state significant at the state 0-10cm depth and 20.1-30.0 cm distance (Table No.9, Fig. No.39).

The population of Female *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state 0-10.0cm depth and 0-10 cm,10.1-20.0 cm distance (Table No. 9, Fig. No.37 & 38).

V=10.1-20.0 CM

The population of Female *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-

20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance .(Table No.9 Fig. No.40,41 & 42).

V=20.1-30.0 CM

The population of Female *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better state significant at the state 20.1-30.0 cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.9, Fig. No.43,44 & 45).

B. Female Population: 1998-99

V = 0 – 10 CM

The population of Female *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10.0 cm depth and 0-10 cm, 20.1-30.0 cm, distance (Table No. 10 Fig. No.46 & 48).

The population of Female *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state 0-10.0cm depth and 10.1-20.0 cm distance (Table No. 10, Fig. No.47).

V=10.1-20.0 CM

The population of Female *Hoplolaimus johani* increases around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No. 10 Fig. No.50).

The population of Female *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state 1.0-20.0 cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No. 10, Fig. No.49 & 51).

V=20.1-30.0 CM

The population of Female *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better state significant at the state20.1-30.0 cm depth and 0-10 cm distance (Table No. 10 Fig. No. 52).

The population of Female *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better state significant at the state20.1-30.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 10 Fig. No.53 &54).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

The Larva population of *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0cm distance (Table No. 9 Fig. No. 37,38 & 39)

V=10.1-20.0 CM

The Larva population of *Hoplolaimus johani* declined around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 9 Fig. No. 40,41 & 42)

V=20.1-30.0 CM

The Larva population of *Hoplolaimus johani* declined around the *Zyzyphus jujuba* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 9 Fig. No. 43,44 & 45).

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state 0-10 cm depth and 0-10 cm distance (Table No. 10, Fig. No. 46).

The Larva population of *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10 cm depth and 10.1-20.0 cm distance (Table No. 10 Fig. No. 47)

The Larva population of *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10 cm depth and 20.1-30.0 cm distance (Table No. 10 Fig. No. 48)

V=10.1-20.0 CM

The Larva population of *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No.10, Fig. No.50)

The Larva population of *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 10.1- 20.0 cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No. 10, Fig. No.49 &51)

V=20.1-30.0 CM

The Larva population of *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1- 30.0 cm depth and 0-10 cm,10.1-20.0cm distance (Table No. 10, Fig. No. 52 &53).

The Larva population of *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 20.1- 30.0 cm depth and 20.1-30.0cm distance (Table No. 10, Fig. No.54).

TOTAL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM

Total population of *Hoplolaimus johani* decreased around the *Zyzyphphusjuba* showing better significant at the state 0-10 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0cm distance (Table No. 9, Fig. No.37,38 & 39).

V=10.1-20.0CM

Total population of *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0cm distance (Table No. 9, Fig. No.40, 41 &42).

V=20.1-30.0CM

Total population of *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 20.1- 30.0 cm depth and 0-10 cm, 10.1-20.0cm, 20.1-30.0cm distance (Table No. 9, Fig. No.43,44 & 45).

A. Total Population: 1998-99

V = 0 – 10 CM

Total population of *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 0-10cm depth and 0-10cm,20.1-30.0cm, distance (Table No. 10, Fig. No.46 &48).

Total population of *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 0-10cm depth and 10.1-20.0cm, distance (Table No. 10, Fig. No.47).

V=10.1-20.0CM

Total population of *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state 10.1-20.0 cm depth and 0-10 cm distance (Table No. 10, Fig. No.49)

Total population of *Hoplolaimus johani* highly increased around the *Zyzyphus us juba* showing better significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm,20.1-30.0cm, distance (Table No. 10, Fig. No.50 & 51).

V=20.1-30.0CM

Total population of *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm distance (Table No. 10, Fig. No.52 & 53).

Total population of *Hoplolaimus johani* around the *Zyzyphus jujuba* is not significant at the state 20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No. 10, Fig. No.54)

In this present study the total nematode population showed inverse relationship with soil temperature at all three vertical depths and horizontal distances, however parasitic population showed positive correlation with soil temperature in male at 0-10 cm vertical depth at 20.1-30.0 cm horizontal distance, 10.1-20.0 cm & 20.1-30.0 cm vertical depth at all three horizontal distances during 1998-99, in female at all three depths and distances during 1998-99,. In larva at 0-10 cm vertical depth and all three distances during 1997-98 and at all three depth and distances during 1998-99, in total population 0-10 cm depth at 0-10 cm, 20.1-30.0 cm distances, 10.1-20.0 cm , depth at 10.1-20.0 cm & 20.1-

30.0 cm distances and 20.1-30.0 cm depth at 0-10 cm, 10.1-20.0 cm distances during 1998-99 (Table No. 9 & 10, Fig. No. 37-54).

Ross 1962, Thorne 1968, Norton 1978, Zirakparvar 1980, Mallik 1980 and **Rai 1985** reported the temperature around $30 \pm 1^{0}C$ was found to be the most suitable for the reproduction of the nematodes, the present investigation exhibited well-defined temperature dependent density oscillation cycle. Positive co-relation with soil temperature in male, female, larva and total is one of the most significant aspect at 0-10 cm, 10.1-20.0 cm and 20.1-30 cm vertical depths and distances during the period of study. The linear regression trends also provide evidence in favor of this observation. **Khan et. al. 1971** didn't find any definite correlation in the population of *Hoplolaimus* sp. to soil temperature around *M. indica*. **Baghel et.al. 1982** studied effect of soil temperature on population fluctuation in a combined population of as many as 8 plant nematode sp. including *Hoplolaimus* sp. and observed that the soil temperature was unfavorable for the build up of total nematode population. No statistical inferences have been drawn to establish correlation of soil temperature and population in the above studies.

EFFECT OF SOIL MOISTURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

The population of male *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 0-10cm depth and 0-10 cm,10.1-20.0 cm, 20.1-30.0 cm distance(Table No. 11, Fig. No. 37,38 & 39).

V=10.1-20.0 CM

The population of male *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm depth and 0-10 cm,10.1-20.0 cm, 20.1-30.0 cm distance(Table No. 11, Fig. No. 40,41 &42).

V=20.1-30.0 CM

The population of male *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance(Table No. 11, Fig. No. 43,44 & 45).

A. Male Population: 1998-99

V = 0 – 10 CM

Population of male *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10 cm,10.1-20.0 cm, 20.1-30.0cm distance (Table No. 12, Fig. No.46,47 &48).

V=10.1-20.0 CM

Population of male *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm,. distance (Table No. 12, Fig. No.49).

Population of male *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 12, Fig. No.50 & 51).

V=20.1-30.0 CM

Population of male *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.12 , Fig. No. 52, 53 & 54).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

Population of Female *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10cm.,10.1-20.0 cm.20.1-30.0cm distance (Table No. 11, Fig. No.37,38 &39).

V=10.1-20.0 CM

Population of Female *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 20.1-30.0 cm distance (Table No. 11, Fig. No.40 & 42).

Population of Female *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm, distance (Table No. 11, Fig. No.41).

V=20.1-30.0 CM

Population of Female *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10 cm, 20.1-30.0 cm distance (Table No. 11, Fig. No.43 & 45).

Population of Female *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm distance (Table No. 11, Fig. No.44).

B. Female Population: 1998-99

V = 0 – 10 CM

Population of female *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 10.1-20.0 cm , 20.1-30.0 cm distance (Table No. 12, Fig. No.46 ,47 &48).

V=10.1-20.0 CM

Population of female *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm , 20.1-30.0 cm distance (Table No. 12, Fig. No.49,50 & 51).

V=20.1-30.0 CM

Population of female *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 12, Fig. No.52,53 & 54).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

Population of Larva of *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10cm, 10.1-20.0 cm distance (Table No. 11, Fig. No.37 & 38).

The Larva population of *Hoplolaimus johani* is not significant at the state of 0-10 cm depth and 20.1-30.0 cm distance (Table No. 11, fig No.39)

V=10.1-20.0 CM

Population of Larva of *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 11, Fig. No.40, 41 & 42).

V=20.1-30.0 CM

The population of Larva of *Hoplolaimus johani* is not significant at the state of 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm distance (Table No. 11, Fig. No.43 &44)

Population of Larva of *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 20.1-30.0 cm distance (Table No. 11, Fig. No.45).

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 10.1-20.0 cm , 20.1-30.0 cm distance (Table No. 12, Fig. No.46,47 &48).

V=10.1-20.0 CM

The Larva population of *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0

cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 12, Fig. No.49,50 & 51).

V=20.1-30.0 CM.

The Larva population of *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 12, Fig. No.52,53 & 54).

TOTAL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM.

Total population of *Hoplolaimus johani* is not significant at the state of 0-10 cm depth and 10.1-20.0cm distance (Table No. 11, fig No.38)

Total Population of *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10cm, 20.1-30.0 cm distance (Table No. 11, Fig. No.37 & 39).

V=10.1-20.0 CM

Total Population of *Hoplolaimus johani* decreased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 11, Fig. No.40,41 &42).

V=20.1-30.0 CM

Total Population of *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10 cm distance (Table No. 11, Fig. No.43).

Total Population of *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 11, Fig. No.44 & 45).

B. Total Population: 1998-99

V = 0 – 10 CM

Total Population of *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 10.1-20.0 cm , 20.1-30.0 cm distance (Table No. 12, Fig. No.46 ,47 & 48).

V=10.1-20.0 CM

Total Population of *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 20.1-30.0 cm distance (Table No. 12, Fig. No.49 &51).

Total Population of *Hoplolaimus johani* increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm distance (Table No. 12, Fig. No.50).

V=20.1-30.0 CM

Total Population of *Hoplolaimus johani* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 12, Fig. No.52,53 & 54).

Population showed consistent correlation with temperature at all 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm depth and at all 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distances.

Similar interrelationship of *Hoplolaimus johani* was observed with soil moisture.

In the present investigation the total nematode population showed positive relationship with soil moisture at all 3 vertical depths during 1997-98 & 1998-99. The linear regression trends indicate that the population of nematode with increase of soil moisture level. The influence of soil moisture on population fluctuations of phytonematodes around *Zyzyphus jujuba* was studies during June1997 to May 1999.one of the significant aspects was a noticeable inverse relationship of total, male, female and larvae population of *Hoplolaimus* with soil moisture in male at 0-10 cm vertical depth & all 3 horizontal distances, in female at 0-10cm vertical depth & all 3 horizontal distances, 10.1-20.0cm vertical

depth & at 0-10cm, 20.1-30.0cm horizontal distance, in larvae 0-10cm & 10.1-20.0cm vertical depths and at all 3 horizontal distances, in total population 0-10cm vertical depth and 0-10cm, 20.1-30.0cm horizontal distances and at 10.1-20.0cm vertical depth at all 3 horizontal distances during 1997-98. The linear regression trends clearly indicate that the population of *Hoplolaimus johani* at above mentioned depths and distances decrease with increase of soil moisture levels. **Prasad** & **Jha 1969** reported optimum range soil moisture percentage 14-19% and **Rai 1985** gives 12%, suitable for nematode population. Population as expressed in the present study has also been expressed by **Khan et. al. 1971** & **Siddiqui et. al. 1972**(Table No. 11 & 12, Fig No. 37-54).

EFFECT OF SOIL TEMPERATURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

The population of male *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10cm depths and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.13, Fig. No. 56 &57).

The population of male *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state of 0-10 cm depth and 0-10 cm distance (Table No.13, Fig. No.55).

V=10.1-20.0CM

The population of male *Dolicorhynchus allahabadensis* .decreased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 20.1-30.0 distance (Table No.13 Fig. No.58 & 60).

The population of male *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state of 10.1-20.0cm depth and 10.1-20.0 cm distance (Table No.13, Fig. No.59).

V=20.1-30.0 CM

The population of male *Dolicorhynchus allahabadensis* is decreased around the *Zyzyphus jujuba* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm,10.1-20.0cm, 20.1-30.0cm distance (Table No.13, Fig. No.61,62 & 63).

B. Male Population: 1998-99

V = 0 – 10 CM

The population of male *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10cm depth and 0-10.0 cm, 20.1-30.0cm distance (Table No.14, Fig. No.64 & 66).

The population of male *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 0-10.0 cm depth and 10.1-20.0 cm distance (Table No.14, Fig. No.65).

V=10.1-20.0 CM

The population of male *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 0-10.0 cm,10.1-20.0 cm, 20.1-30.0cm distance (Table No.14, Fig. No.67,68 &69).

V=20.1-30.0 CM

The population of male *Dolicorhynchus allahabadensis* is increased around the *Zyzyphus jujuba* showing better state significant at the state 20.1-30.0 cm depth and 0-10.0 cm (Table No. 14, Fig No.70).

The population of male *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 20.1-30.0 cm depth and 10.1-20.0 cm distance (Table No. 14, Fig. No.71).

The population of male *Dolicorhynchus allahabadensis* is highly increased around the *Zyzyphus jujuba* showing better state significant at the state 20.1-30.0 cm depth and 20.1-30.0 cm (Table No. 14, Fig No.72).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

The population of Female *Dolicorhynchus allahabadensis* increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10cm depth and 10.1-20.0cm distance (Table No.13, Fig. No.56).

The population of Female *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 0-10.0cm depth and 0-10cm, 20.1-30.0 cm distance (Table No. 13, Fig. No.55 &57).

V=10.1-20.0 CM

The population of Female *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No.13, Fig. No.58 &60).

The population of Female *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No. 13, Fig. No.59).

V=20.1-30.0 CM

The population of Female *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better state significant at the state 20.1-30.0 cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.13, Fig. No.61, 62 & 63).

B. Female Population: 1998-99

V = 0 – 10 CM

The population of Female *Dolicorhynchus allahabadensis* increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10.0 cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm, distance (Table No. 14 Fig. No. 64,65 & 66).

V=10.1-20.0 CM

The population of Female *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 10.1-20.0 cm depth and 0-10.0 cm distance (Table No. 14, Fig. No.67).

The population of Female *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 14 Fig. No. 68 & 69).

V=20.1-30.0 CM

The population of Female *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better state significant at the state20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.14, Fig. No. 70,71 & 72).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10 cm depth and 0-10 cm. distance (Table No. 13 Fig. No. 55)

The Larva population of *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 0-10.0 cm depth and10.1-20.0 cm, 20.1-30.1 cm. distance (Table No.13, Fig. No. 56 & 57).

V=10.1-20.0 CM

The Larva population of *Dolicorhynchus allahabadensis* declined around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 20.1-30.0 cm. distance (Table No.13., Fig. No. 60)

The Larva population of *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 0-10.0 cm depth and 0-10.0cm,10.1-20.0 cm distance (Table No.13, Fig. No. 58 &59).

V=20.1-30.0 CM

The Larva population of *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better significant at the state 20.1- 30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.13, Fig. No.61 ,62 &63)

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better state significant at the state 0-10 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 14, Fig. No.64,65 & 66)

V=10.1-20.0 CM

The Larva population of *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 10.1-20.0 cm. depth and 0-10.0cm distance **(**Table No.14, Fig. No. 67**)**.

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance **(**Table No.14, Fig. No.68 & 69 **)**

V=20.1-30.0 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1- 30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance **(**Table No. 14, Fig. No.70,71 &72**)**.

TOTAL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM

Total population of *Dolicorhynchus allahabadensis* increased around the *Zyzyphus jujuba* showing better significant at the state 0-10 cm depth and 0-10 cm distance **(**Table No.13, Fig. No.55).

Total population of *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 0-10.0 cm depth and 10.1-20.0 cm,20.1-30.0 cm distance **(**Table No. 13, Fig. No.56 &57**)**.

V=10.1-20.0CM

Total population of *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance **(**Table No. 13, Fig. No.59 **)**.

Total population of *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better significant at the state 0-10 cm depth and 0-10 cm, 20.1-30.0cm distance **(**Table No. 13, Fig. No.58 &60**)**.

V=20.1-30.0CM

Total population of *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm depth and 0-10cm,10.1-20.0cm, 20.1-30.0cm distance (Table No. 13, Fig. No.61, 62 &63).

B. Total Population: 1998-99

V = 0 – 10 CM

Total population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 0-10cm depth and 0-10cm,10.1-20.0cm, 20.1-30.0 cm distance (Table No. 14, Fig. No.64,65 & 66).

V=10.1-20.0CM

Total population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0cm depth and 0-10cm,10.1-20.0cm, 20.1-30.0 cm distance (Table No. 14, Fig. No.67,68 & 69).

V=20.1-30.0CM

Total population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0cm depth and 0-10cm,20.1-30.0cm distance (Table No. 14, Fig. No.70 & 72).

Total population of *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 20.1-30.0 cm depth and 10.1-20.0 cm distance (Table No. 14, Fig. No. 71).

The variations in *Dolicorhynchus allahabadensis* population around *Zyzyphus jujuba* were more consistent at a distance of 20.1-30.0cm then other distances.

However significance consistence in variations of *Dolicorhynchus allahabadensis* population was observed at 10.1-20.0cm and 20.1-30.0cm distances but only at 10.1-20.0cm and 20.1-30.0cm depth in 1998-99.

In the present investigation the male, female, larva and total population of *Dolichorhynchus allahabadensis* showed positive

correlation with soil temperature at 0-10cm, 10.1-20.0cm, 20.1-30.0cm vertical depths and at all 3 horizontal distances during 1997-98 & 1998-99. Linear regression trends also provide eve dense in favor of this observation. During 1997-98 few stages of vertical depths and horizontal distances showing inverse relationship of male, female, larva and total population with soil temperature. **Siddiqui et. al. 1973** reported an increase reproduction and population growth of *Tylenchorhynchus brassicae* around cauli flower and cabbage. Which is quite in agreement with present investigation. **Griffing** & **Darting 1964** stated that soil Nematode population increased at cooler temperature. Observations and **Pereira** & **Santosh 1974** is also inconformity with present study (Table No. 13 & 14, Fig No. 55-72).

EFFECT OF F SOMOISTURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

Population of male *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10 cm distance (Table No. 15, Fig. No.55).

Population of male *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 0-10.0 cm depth and 10.1-20.0 cm, 20.1-30.0cm distance (Table No. 15, Fig. No.56 &57).

V=10.1-20.0 CM

Population of male *Dolicorhynchus allahabadensis* around the *Zyzyphus jujuba* is not significant at the state 10.1-20.0 cm depth and, 0-10.0 cm distance (Table No. 15, Fig. No. 58).

Population of male *Dolicorhynchus allahabadensis* highly decreased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm,20.1-30.0cm distance (Table No. 15, Fig. No.59 & 60).

V=20.1-30.0 CM

Population of male *Dolicorhynchus allahabadensis* increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10 cm, 10.1-20.0 cm distance (Table No. 15, Fig. No.61 & 62).

Population of male *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 20.1-30.0 cm. distance (Table No. 15, Fig. No.63).

B. Male Population: 1998-99

V = 0 – 10 CM

The population of male *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 0-10cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16, Fig. No. 64,65 & 66).

V=10.1-20.0 CM

Population of male *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm,10.1-20.0 cm,20.1-30.0cm. distance (Table No. 16, Fig. No.67,68 & 69).

V=20.1-30.0 CM

Population of male *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm,10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16, Fig. No.70,71 & 72).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

The population of female *Dolicorhynchus allahabadensis* is not significant at the state of 0-10cm depth and0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table no. 15, Fig. No.55, 56 & 57)

V=10.1-20.0 CM

Population of Female *Dolicorhynchus allahabadensis* increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm distance (Table No. 15, Fig. No.58).

Population of Female *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm distance (Table No. 15, Fig. No.59).

The population of female *Dolicorhynchus allahabadensis* is not significant at the state of 10.1-20.0 cm .depth and 20.1-30.0 cm distance (Table no. 15, Fig. No.60)

V=20.1-30.0 CM

The population of female *Dolicorhynchus allahabadensis* is not significant at the state of of 21-30.0 cm depth and 0-10 cm distance (Table no. 15, Fig. No.61)

Population of female *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better Significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm distance (Table No. 15, Fig. No.62).

Population of female *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No. 15, Fig. No.63).

B. Female Population: 1998-99

V = 0 – 10 CM

Population of female *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0 cm depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16, Fig. No.64, 65 & 66).

V=10.1-20.0 CM

Population of female *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16, Fig. No.67,68 & 69).

V=20.1-30.0 CM

Population of female *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16 , Fig. No.70,71 & 72).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* is not significant at the state of 0-10 cm depth and 0-10cm,10.1-20.0 cm distance (Table No. 15, fig No.55 &56).

Population of Larva of *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better Significant at the state 0-10.0cm depth and 20.1-30.0 cm distance (Table No. 15, Fig. No.57)

V=10.1-20.0 CM

Population of Larva of *Dolicicorchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better Significant at the state 10.1-20.0 cm. depth and 0-10.0cm,10.1-20.0 cm distance (Table No. 15, Fig. No.58 &59).

The Larva population of *Dolicorhynchus allahabadensis* is not significant at the state of 10.1-20.0 cm depth and 20.1-30.0 cm.distance (Table No. 15, fig No.60).

V=20.1-30.0 CM

Population of Larva of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better Significant at the state 20.1-30.0 cm. depth and 0-10 cm distance (Table No. 15, Fig. No.61).

Population of Larva of *Dolicorhynchus allahabadensis* increased around the *Zyzyphus jujuba* showing better Significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm distance (Table No. 15, Fig. No.62).

Population of Larva of *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better Significant at the state 20.1-30.0 cm. depth and 20.1-30.0 cm distance (Table No. 15, Fig. No.63).

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10.0cm,10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16, Fig. No.64,65 &66).

V=10.1-20.0 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and0-10cm, 10.1-20.0 cm distance (Table No. 16, Fig. No.67 &68).

The Larva population of *Dolicorhynchus allahabadensis* increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 20.1-30.0 cm distance (Table No. 16, Fig. No.69).

V=20.1-30.0 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better Significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16, Fig. No.70,71 &72).

TOTAL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM

Total population of *Dolicorhynchus allahabadensis* is not significant at the state of 0-10 cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 15, fig No.55,56 & 57)

V=10.1-20.0 CM

Total Population of *Dolicorhynchus allahabadensis* decreased around the *Zyzyphus jujuba* showing better Significant at the state .10.1-20.0 cm. depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 15, Fig. No.58,59 &60).

V=20.1-30.0 CM

Total population of *Dolicorhynchus allahabadensis* is not significant at the state of 20.1-30.0 cm depth and 0-10cm distance (Table No. 15, fig No.61)

Total Population of *Dolicorhynchus allahabadensis* increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 15, Fig. No.62 &63).

B. Total Population: 1998-99

V = 0 – 10 CM

Total Population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16, Fig. No.64,65 &66).

V=10.1-20.0 CM

Total Population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16, Fig. No.67,68 &69).

V=20.1-30.0 CM.

Total Population of *Dolicorhynchus allahabadensis* highly increased around the *Zyzyphus jujuba* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 16, Fig. No.70,71 &72).

Similar as observed with temperature consistency of significance co-relation by *Dolicorhynchus allahabadensis* with moisture was observed in 1998-99, then 1997-98.

The variations in population were not significant with moisture during 1997-98 at all-0-10.0 cm, 10.1-20.0 cm, and 20.1-30.0 cm depths and at 0-10cm distances.

The influence of soil moisture on population fluctuation of *Dolichorhynchus allahabadensis* around *Zyzyphus jujuba* showed positive correlation with soil moisture during 1997-98 & 1998-99. the linier regression trends also proved above correlation with soil moisture but one of the most significant aspect was inverse relationship of male, female, larva and population at few vertical depth and distances during 1997-98. However this investigation is also expressed by **Prasad** & **Jha 1969, Khan et. al. 1971, Siddiqui et. al. 1972** and **Rai 1985(**Table No. 15 & 16, Fig No. 55-72**)**.

Host Plant: *Carrica papaya*

Species 1: *Hoplolaimus johani*

EFFECT OF SOIL TEMPERATURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM-

The population of male *Hoplolaimus johani* decreased around d th

depth and 0-10 cm, 20.1-30.0 cm distance (Table No 17, Fig. No.73 & 75).

The population of male *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state of 0-10 cm depth and 10.1-20.0cm distance (Table No. 17 Fig. No.74).

V=10.1-20.0cm: -

The population of male *Hoplolaimus johani* decreased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.17 Fig. No.76,77 &78).

V=20.1-30.0 CM

The population of male *Hoplolaimus johani* is decreased around the *Carrica papaya* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.17, Fig. No.79,80 &81).

B. Male Population: 1998-99

V = 0 – 10 CM

The population of male *Hoplolaimus johani* increased around the *Carrica papaya* showing better state significant at the state 0-10cm depth and 0-10 cm distance (Table No.18, Fig. No.82).

The population of male *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better state significant at the state

0-10cm depth and 10.1-20.0cm, 20.1-30.0 cm distance (Table No.18, Fig. No.83 & 84).

V=10.1-20.0 CM

The population of male *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.18, Fig. No.85,86 &87).

V=20.1-30.0 CM

The population of male *Hoplolaimus johani* is highly increased around the *Carrica papaya* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.18, Fig. No.88,89 & 90).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

The population of Female *Hoplolaimus johani* Declined around the *Carrica papaya* showing better state significant at the state 0-10cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No.17, Fig. No.73 & 75).

The population of Female *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 0-10.0cm depth and 10.1-20.0 cm distance (Table No. 17, Fig. No.74).

V=10.1-20.0 CM

The population of Female *Hoplolaimus johani* decreased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.17 Fig. No. 76,77& 78).

V=20.1-30.0 CM-

The population of Female *Hoplolaimus johani* decreased around the *Carrica papaya* showing better state significant at the state 20.1-30.0 cm depth and 0-10cm, 10.1-20.0 cm distance (Table No.17, Fig. No.79 &80).

The population of Female *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No. 17, Fig. No.81).

B. Female Population: 1998-99

V = 0 – 10 CM

The population of Female *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better state significant at the state 0-10.0 cm depth and 0-10 cm, 20.1-30.0 cm, distance (Table No. 18 Fig. No. 82 &84).

The population of Female *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 0-10.0cm depth and 10.1-20.0 cm distance (Table No. 18, Fig. No.83).

V=10.1-20.0 CM

The population of Female *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 18 Fig. No. 85,86 & 87).

V=20.1-30.0 CM

The population of Female *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better state significant at the state20.1-30.0 cm depth and 0-10 cm,10.1-20.0 cm distance (Table No. 18 Fig. No. 88 &89).

The population of Female *Hoplolaimus johani* increased around the *Carrica papaya* showing better state significant at the state20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No. 18 Fig. No. 90).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

The Larva population of *Hoplolaimus johani* decreased around the *Carrica papaya* showing better state significant at the state 10.1-

20.0 cm depth and 0-10 cm, 20.1-30.0cm distance (Table No. 17 Fig. No 73 & 75)

The larva population of *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state of 0-10cm depth and 10.1-20.0cm distance(Table No.17,Fig.No.74)

V=10.1-20.0 CM

The Larva population of *Hoplolaimus johani* declined around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 17 Fig. No. 76,77 &78)

V=20.1-30.0 CM

The Larva population of *Hoplolaimus johani* declined around the *Carrica papaya* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm distance (Table No. 17 Fig. No. 79 &80)

The larva population of *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state of 20.1-30.0 cm depth and 20.1-30.0 cm distance (Table No.17, Fig. No.81) .

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 0-10 cm depth and 0-10 cm, 20.1-30.0 cm distance (Table No. 18, Fig. No.82 & 84).

The Larva population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better state significant at the state 0-10 cm depth and 10.1-20.0 cm distance (Table No. 18 Fig. No. 83)

V=10.1-20.0 CM

The Larva population of *Hoplolaimus johani* increased around the *Carrica papaya* showing better significant at the state 10.1- 20.0 cm depth and 0-10 cm distance (Table No. 18, Fig. No.85)

The Larva population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 10.1-

20.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 18, Fig. No.86 & 87)

V=20.1-30.0 CM

The Larva population of *Hoplolaimus johani* increased around the *Carrica papaya* showing better significant at the state 20.1- 30.0 cm depth and 0-10 cm distance (Table No. 18, Fig. No.88)

Larva population of *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state of 20.1-30.0cm depth and 10.1-20.0cm distance (Table No. 18, Fig. No.89)

The Larva population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm depth and 20.1-30.0cm distance (Table No. 18, Fig. No.90)

TOTAL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM

Total population of *Hoplolaimus johani* around the *Carrica papaya* is not significant of 0-10cm depth and 0-10cm, 10.1-20.0cm distance. (Table No. 17, Fig. No. 73 &74)

Total population of *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 0-10 cm depth and 20.1-30.0cm distance. (Table No. 17, Fig. No.75)

V=10.1-20.0CM

Total population of *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0cm distance (Table No. 17, Fig. No.76, 77 &78)

V=20.1-30.0CM

Total population of *Hoplolaimus johani* around the *Carrica papaya* is not significant of 20.1-30.0cm depth and 0-10cm distance. (Table No. 17, Fig. No.79)

Total population of *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 20.1- 30.0 cm

depth and 10.1-20.0cm, 20.1-30.0cm distance (Table No.17, Fig. No.80 & 81).

B. Total Population: 1998-99

V = 0 – 10 CM

Total population of *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state of 0-10cm depth and 10.1-20.0cm distance. (Table No. 18, Fig. No.83)

Total population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 0-10cm depth and 0-10cm, 20.1-30.0cm distance (Table No. 18, Fig. No.82 & 84)

V=10.1-20.0CM

Total population of *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 10.1-20.0 cm depth and 0-10 cm distance (Table No. 18, Fig. No.85)

Total population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm, 20.1-30.0cm, distance (Table No. 18, Fig. No.86 & 87)

V=20.1-30.0CM

Total population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 18, Fig. No.88,89 &90)

The influence of soil temperature on Phytonematode population has analysed by **Burkhalter 1928, Goheen** & **Williams 1955, Norton 1959, Lewis & Mai 1960, Ross 1962, Griffin & Darting 1964, Edward et. al. 1965, Prasad** and **Chawla 1965, Seinhorst 1966, Thorne 1968, Miyagava** & **Lear 1970, Khan et. al. 1971, Siddiqui et. al. 1973, Pereira** & **Santos 1974, Norton 1978, Zirakparvar 1980, Baghel** & **Bhatti 1982** and **Rai.**

The present investigation carried out during the period June 1997 to May 1999 exhibited well defined temperature dependent density oscillation cycles. In the present study the male, female, larva

and total population showed inverse relationship with soil temperature but one of the most noticeable significant aspects was that the few stages of horizontal distances at all 3 vertical depths showed positive correlation soil temperature the linear regression trends also provide evidence in favor of this observation (Table No. 17 & 18, Fig No. 73-90).

EFFECT OF SOIL MOISTURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

The population of male *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 0-10cm depth and 0-10 cm, 10.1-20.0 cm distance (Table No. 19, Fig. No 73&74).

The population of male *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 0-10cm depth and 20.1-320.0 cm distance(Table No. 19, Fig. No75).

V=10.1-20.0 CM

The population of male *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 10.1-20.0 cm depth and 20.1-30.0 cm distance (Table No. 19, Fig. No78).

The population of male *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm depth and 0-10.0 cm, 10.1-20.0 cm distance (Table No. 19, Fig. No 76&77).

V=20.1-30.0 CM

The population of male *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance(Table No. 19, Fig. No79, 80 &81).

B. Male Population: 1998-99

V = 0 – 10 CM

Population of male *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0cm distance (Table No. 20, Fig. No 82, 83 &84).

V=10.1-20.0 CM

Population of male *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm. distance (Table No. 20, Fig. No 85, 86 & 87).

V=20.1-30.0 CM

Population of male *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. .

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM.

Population of Female *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 0-10cm., 10.1-20.0 cm. distance (Table No. 19, Fig. No 73 &74).

Population of Female *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 0-10.0cm depths and 20.1-30.0 cm. distance (Table No. 19, Fig. No75).

V=10.1-20.0 CM.

Population of Female *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 10.1-20.0 cm. depth and 0-10.0 cm distance (Table No. 19, Fig. No 76).

Population of Female *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm.

B. Male Population: 1998-99

V = 0 – 10 CM

Population of male *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0cm distance (Table No. 20, Fig. No 82, 83 &84).

V=10.1-20.0 CM

Population of male *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm. distance (Table No. 20, Fig. No 85, 86 & 87).

V=20.1-30.0 CM

Population of male *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 20, Fig. No 88, 89 & 90).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM.

Population of Female *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 0-10cm., 10.1-20.0 cm. distance (Table No. 19, Fig. No 73 &74).

Population of Female *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 0-10.0cm depths and 20.1-30.0 cm. distance (Table No. 19, Fig. No75).

V=10.1-20.0 CM.

Population of Female *Hoplolaimus johani* around the *Carrica papaya* is not significant at the state 10.1-20.0 cm. depth and 0-10.0 cm distance (Table No. 19, Fig. No 76).

Population of Female *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm.

and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm. distance (Table No. 19, Fig. No73, 74 & 75)

V=10.1-20.0 CM.

Population of Larva of *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 19, Fig. No76,77 & 78)

V=20.1-30.0 CM.

Population of Larva of *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10 cm. distance (Table No. 19, Fig. No 79).

Population of Larva of *Hoplolaimus johani* increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm. distance (Table No. 19, Fig. No 80).

The population of Larva of *Hoplolaimaimusohani* is not significant at the state of 20.1-30.0 cm depth and 20.1-30.0 cm. distances (Table No. 19, Fig. No 81)

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.20, Fig. No 82,83 & 84).

V=10.1-20.0 CM.

The Larva population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.20, Fig. No 85,86 & 87).

V=20.1-30.0 CM.

The Larva population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.20, Fig. No 88, 89 & 90).

TOTAL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM

Total Population of *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 19, Fig. No 73, 74 & 75).

V=10.1-20.0 CM.

Total Population of *Hoplolaimus johani* decreased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 19, Fig. No 76, 77 &78).

V=20.1-30.0 CM.

Total Population of *Hoplolaimus johani* increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10 cm distance (Table No. 19, Fig. No 79).

Total Population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm. distance (Table No. 19, Fig. No 80 & 81)

B. Total Population: 1998-99

V = 0 – 10 CM

Total Population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 20, Fig. No 82, 83 & 84)

V=10.1-20.0 CM.

Total Population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.20, Fig. No 85,86 & 87)

V=20.1-30.0 CM.

Total Population of *Hoplolaimus johani* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 20, Fig. No 88,89 & 90)

The significant with temperature was better at a depth of 20.1-30.0 cm particularly at a distance of 10.1-20.0 cm and 20.1-30.0 cm during both the years 1997-98 and 1998-99.

However this parasite showed better correlation with variation in soil moisture at 0-10.0 cm, 10.1-20.0 cm, 20.1-30.0 cm distances and 0-10.0 cm, 10.1-20.0 cm, 20.1-30.0 cm depth during 1997-98 and 1998-99.

In the present investigation the total, male, female and larvae population of *Hoplolaimus johani* positive correlation with soil moisture but few stages of vertical depths and horizontal distances in male, female, larvae and total population showed inverse relationship with soil moisture. A considerable body of evidence is available to indicate that soil moisture and good aeration abundance of both lead to increased parasitic abundance in soil. **Jone's 1959, Griffin** & **Darting 1964, Prasad & Jha 1969, Wallace 1971, Khan et. al. 1971, Siddiqui et. al. 1973, Brodie 1976, Norton 1978** and **Das** & **Mishra 1982** had reported similar finding (Table No. 19 & 20, Fig No. 73-90).

EFFECT OF SOIL TEMPERATURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

The population of male *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better state significant at the state 0-10cm depths and 0-10.0 cm. distance (Table No.21, Fig. No 91).

The population of male *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better state significant at the state 0-10cm depth and 10.1-20.0 cm distance (Table No.21, Fig. No 92).

The population of male *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better state significant at the state 0-10cm depth and 20.1-30.0 cm distance **(le No.21, Fig. No 93)**.

V=10.1-20.0CM

The population of male *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 0-10 cm, 10.1-20.0 cm., 20.1-30.0 distance (Table No.21 Fig. No 94, 95 & 96).

V=20.1-30.0 CM

The population of male *Dolicorhynchus allahabadensis* is decreased around the *Carrica papaya* showing better state significant at the state 20.1-30.0 cm depth and 0-10 cm,10.1-20.0cm, 20.1-30.0cm distance (Table No.21, Fig. No97, 98 & 99).

B. Male Population: 1998-99

V = 0 – 10 CM

The population of male *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better state significant at the state 0-10cm depth and 0-10.0 cm, 10.1-20.0 cm, 20.1-30.0cm distance (Table No.22, Fig. No 100, 101 & 102).

V=10.1-20.0 CM

The population of male *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 0-10.0 cm, 20.1-30.0cm distance (Table No.22, Fig. No 103 & 105).

The population of male *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No.22, Fig. No. 104).

V=20.1-30.0 CM

The population of male *Dolicorhynchus allahabadensis* is highly increased around the *Carrica papaya* showing better state significant at the state 20.1-30.0 cm depth and 0-10.0 cm., 20.1-30.0 cm (Table No. 22, Fig No. 106 & 108).

The population of male *Dolicorhynchus allahabadensis* is increased around the *Carrica papaya* showing better er ste significant at the state 20.1-30.0 cm depth and 10.1-20.0 cm. (Table No. 22, Fig No. 107).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

The population of Female *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better state significant at the state 0-10cm depth and 0-10.0cm. distance (Table No.21, Fig. No. 91).

The population of Female *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better state significant at the state 0-10cm depth and 10.1-20.0cm, 20.1-30.0 cm distance (Table No.21, Fig. No. 92 & 93).

V=10.1-20.0 CM

The population of Female *Dolicorhynchus allahabadensis* around the *Carrica papaya* is not significant at the state 10.1-20.0 cm depth and 0-10 cm. distance (Table No. 21, Fig. No. 94).

The population of Female *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm., 20.1-30.0 cm distance (Table No.21, Fig. No. 95 & 96).

V=20.1-30.0 CM

The population of Female *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better state significant at the state 20.1-30.0 cm depth and 0-10cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.21, Fig. No. 97, 98 & 99).

B. Female Population: 1998-99

V = 0 – 10 CM

The population of Female *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better state significant at the state 0-10.0 cm depth and 0-10cm, 10.1-20.0 cm. distance (Table No. 22 Fig. No. 100 & 101).

The population of Female *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better state significant at the state 0-10.0 cm depth and 20.1-30.0 cm, distance (Table No. 22. Fig. No. 102).

V=10.1-20.0 CM

The population of Female *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 0-10.0 cm., 20.1-30.0 cm distance (Table No. 22., Fig. No. 103 & 105).

The population of Female *Dolicorhynchus allahabadensis* around the *Carrica papaya* is not significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No. 22; Fig. No. 104).

V=20.1-30.0 CM

The population of Female *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better state significant at the state20.1-30.0 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.22, Fig. No. 106, 107 & 108).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* highly decreased around the *Carrica papaya* showing better state significant at the state 0-10 cm depth and 0-10 cm., 10.1-20.0 cm. distance (Table No. 21, Fig. No. 91 & 92)

The Larva population of *Dolicorhynchus allahabadensis* around the *Carrica papaya* is not significant at the state 0-10.0 cm depth and 20.1-30.1 cm. distance (Table No.21, Fig. No. 93).

V=10.1-20.0 CM

The Larva population of *Dolicorhynchus allahabadensis* declined around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 0-10.0cm,10.1-20.0 cm. 20.1-30.0 cm. distance (Table No.21., Fig. No. 94, 95 & 96)

V=20.1-30.0 CM

The Larva population of *Dolicorhynchus allahabadensis*_ around the *Carrica papaya* is not significant at the state 20.1- 30.0 cm depth and 0-10.0 cm distance (Table No.21, Fig. No. 97)

The Larva population of *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state 20.1- 30.0 cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.21, Fig. No. 98, 99)

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better state significant at the state 0-10 cm depth and 0-10 cm. distance (Table No. 22, Fig. No. 100)

The Larva population of *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better state significant at the state 0-10 cm depth and 10.1-20.0 cm distance (Table No. 22, Fig. No. 101)

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better state significant at the state 0-10 cm depth and 20.1-30.0 cm distance (Table No. 22, Fig. No. 102)

V=10.1-20.0 CM

The Larva population of *Dolicorhynchus allahabadensis* around the *Carrica papaya* is not significant at the ststat0.1-20.0 cm. depth and 0-10.0cm distance (Table No.22, Fig. No. 103).

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm distance (Table No.22, Fig. No. 104)

The Larva population of *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better state significant at the state 10.1-20.0 cm depth and 20.1-30.0 cm distance (Table No.22, Fig. No. 105)

V=20.1-30.0 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 20.1- 30.0 cm depth and 0-10 cm,10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 22, Fig. No. 106, 107 & 108).

TOTAL MALE POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM

Total population of *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state 0-10 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.21, Fig. No. 91, 92 & 93).

V=10.1-20.0CM

Total population of *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state 0-10 cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0cm distance (Table No. 21, Fig. No. 94, 95 & 96).

V=20.1-30.0CM

Total population of *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm depth and 0-10cm,10.1-20.0cm, 20.1-30.0cm distance (Table No. 21, Fig. No. 97, 98 & 99).

B. Male Population: 1998-99

V = 0 – 10 CM

Total population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 0-10cm depth and 0-10cm,10.1-20.0cm, 20.1-30.0 cm distance (Table No. 22, Fig. No. 100, 101 & 102).

V=10.1-20.0CM

Total population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 10.1-20.0cm depth and 0-10cm,10.1-20.0cm, 20.1-30.0 cm distance (Table No. 22, Fig. No. 103, 104 & 105).

V=20.1-30.0CM

Total population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the

state 20.1-30.0cm depth and 0-10cm, 10.1-20.0 cm., 20.1-30.0cm distance (Table No. 22, Fig. No. 106, 107 & 108).

The variations in *Dolicorhynchus allahabadensis* population around *Carrica papaya* were more consistent at a distance of 20.1-30.0cm then other distances.

However significance consistence in variations of *Dolicorhynchus allahabadensis* population was observed at 10.1-20.0cm and 20.1-30.0cm distances but only at 10.1-20.0cm and 20.1-30.0cm depth in 1998-99

In the present study the male, female, larvae and total population showed positive correlation with soil temperature at all 3 vertical depths and distances. The linear regression also proved the above findings one of the significant aspects was that some stages of vertical depths and horizontal distances showed inverse relationship with soil moisture in male female larvae and total population during both the year. *Dolicorhynchus allahabadensis* showed positive correlation with soil temperature. Linear regression trends provide evidence in favor of this observation. **Khan et. al. 1971** did not find any definite correlation in the population of *Hoplolaimus* species. However **Siddiqui et. al. 1973** reported and increased reproduction and population growth of *Tylenchorhynchus brassicae* around cauli flower and cabbage which is quite in agreement with present study this investigation is also inconformity with the observations of **Darting 1964, Pereira** & **Santos 1974, Norton 1978** and **Baghel et. al. 1982** (Table No. 21 & 22, Fig No. 91-108).

EFFECT OF SOIL MOISTURE:

MALE POPULATION

A. Male Population: 1997-98

V = 0 – 10 CM

Population of male *Dolicorhynchus allahabadensis* around the *Carrica papaya* is not significant at the state 0-10.0 cm depth and 0-10 cm., 20.1-30.0cm distance (Table No. 23, Fig. No. 91 & 93).

Population of male *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 10.1-20.0 cm. distance (Table No. 23, Fig. No. 92).

V=10.1-20.0 CM

Population of male *Dolicorhynchus allahabadensis* around the *Carrica papaya* is not significant at the state 10.1-20.0 cm depth and 10.1-20.0 cm. distance (Table No. 23, Fig. No. 95).

Population of male *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0 cm.,20.1-30.0cm distance (Table No. 23, Fig. No. 94 & 96).

V=20.1-30.0 CM

Population of male *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10 cm, 10.1-20.0 cm distance (Table No. 23, Fig. No. 97 & 98).

Population of male *Dolicorhynchus allahabadensis* around the *Carrica papaya* is not significant at the state 20.1-30.0 cm. depth and 20.1-30.0 cm. distance (Table No. 23, Fig. No. 99).

B. Male Population: 1998-99

V = 0 – 10 CM

The population of male *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 0-10cm depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 24, Fig. No. 100, 101 & 102).

V=10.1-20.0 CM

Population of male *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm,10.1-20.0 cm,20.1-30.0cm. distance (Table No. 24, Fig. No. 103, 104 & 105).

V=20.1-30.0 CM

Population of male *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the

state 20.1-30.0 cm. depth and 0-10.0 cm , 20.1-30.0 cm distance (Table No. 24, Fig. No. 106 & 108).

Population of male *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm distance (Table No. 24, Fig. No. 107).

FEMALE POPULATION

A. Female Population: 1997-98

V = 0 – 10 CM

The population of female *Dolicorhynchus allahabadensis* is not significant at the state of 0-10cm depth and0-10cm distance (Table no. 23, Fig. No. 91)

The population of female *Dolicorhynchus allahabadensis* is decreased around the *Carrica papaya* showing better significant at the state of 0-10cm depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table no

V=10.1-20.0 CM

Population of Female *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm distance (Table No. 23, Fig. No. 94).

Population of Female *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm. distance (Table No. 23, Fig. No. 95 & 96).

V=20.1-30.0 CM.

Population of Female *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better Significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 23, Fig. No. 98 & 99).

Population of Female *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm depth and 0-10.0 cm distance (Table No. 23, Fig. No. 97).

A. Female Population: 1998-99

V = 0 – 10 CM

Population of female *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 0-10.0 cm depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.24, Fig. No. 100, 101 & 102).

V=10.1-20.0 CM.

Population of female *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 24, Fig. No. 103, 104 & 105).

V=20.1-30.0 CM.

Population of female *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 24 , Fig. No. 106, 107 & 108).

LARVA POPULATION

A. Larva Population: 1997-98

V = 0 – 10 CM

Population of Larva of *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better Significant at the state 0-10.0cm depth and 0-10cm, 10.1-20.0 cm., 20.1-30.0 cm distance (Table No. 23, Fig. No. 91, 92 & 93)

V=10.1-20.0 CM.

Population of Larva of *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better Significant at the state 10.1-20.0 cm. depth and 0-10.0cm,10.1-20.0 cm, 20.1-30.0 cm. distance (Table No. 23, Fig. No. 94, 95 & 96).

V=20.1-30.0 CM.

Population of Larva of *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better Significant at the

state 20.1-30.0 cm. depth and 0-10 cm distance (Table No. 23, Fig. No. 97).

Population of Larva of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better Significant at the state 20.1-30.0 cm. depth and 10.1-20.0 cm, distance (Table No. 23, Fig. No. 98).

Population of Larva of *Dolicorhynchus allahabadensis* around the *Carrica papaya* is not Significant at the state 20.1-30.0 cm. depth and 20.1-30.0 cm. distance (Table No.23, Fig. No. 99).

B. Larva Population: 1998-99

V = 0 – 10 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 20.1-30.0 cm distance (Table No. 24, Fig. No. 100 & 102).

The Larva population of *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 10.1-20.0 cm. distance (Table No. 24, Fig. No. 101).

V=10.1-20.0 CM

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 10.1-20.0 cm. depth and0-10cm, 10.1-20.0 cm, 20.1-30.0 cm. distance (Table No. 24, Fig. No. 103, 104 & 105).

V=20.1-30.0 CM.

The Larva population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better Significant at the state 20.1-30.0 cm. depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 24, Fig. No. 106, 107 &108).

TOTAL POPULATION

A. Total Population: 1997-98

V = 0 – 10 CM

Total population of *Dolicorhynchus allahabadensis* is not significant at the state of 0-10 cm depth and 0-10cm, 10.1-20.0 cm distance (Table No. 23, fig No. 91 & 92)

Total population of *Dolicorhynchus allahabadensis* decreased around the *Carrica papaya* showing better significant at the state of 0-10 cm depth and 20.1-30.0 cm distance (Table No. 23, fig No. 93)

V=10.1-20.0 CM.

Total Population of *Dolicorhynchus allahabadensis* around the *Carrica papaya* is not Significant at the state 10.1-20.0 cm. depth and 0-10 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 23, Fig. No. 94, 95 & 96).

V=20.1-30.0 CM.

Total Population of *Dolicorhynchus allahabadensis* increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10cm, 20.1-30.0 cm distance (Table No.23, Fig. No. 97 & 99).

Total population of *Dolicorhynchus allahabadensis* is not significant at the state of 20.1-30.0 cm depth and 10.1-20.0 cm distance (Table No.23, fig No. 98)

B. Total Population: 1998-99

V = 0 – 10 CM

Total Population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 0-10.0cm depth and 0-10.0cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No.24, Fig. No. 100,101 & 102).

V=10.1-20.0 CM.

Total Population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the

state 10.1-20.0 cm. depth and 0-10.0 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 24, Fig. No. 103, 104 & 105).

V=20.1-30.0 CM.

Total Population of *Dolicorhynchus allahabadensis* highly increased around the *Carrica papaya* showing better significant at the state 20.1-30.0 cm. depth and 0-10.0 cm, 10.1-20.0 cm, 20.1-30.0 cm distance (Table No. 24, Fig. No. 106, 107 & 108).

The population distribution by *Dolicorhynchus allahabadensis* around *Carrica papaya* showed consistence in significance for inter-relationship with temperature at 0-10.0 cm and 20.1-30.0 cm depth at 0-10.0 cm, 10.1-20.0 cm and 20.1-30.0 cm distribution during both the years 1997-98, 1998-99.

However the correlation of nematodes with soil moisture variation were highly significant statistically at all the 0-10.0 cm, 10.1-.1-20 cm and 20.1-30.0 cm distances during both years 1997-98 and 1998-99.

Population of *Dolicorhynchus allahabadensis* showed positive correlation with soil moisture but some cases of horizontal dispenses of all the 3 vertical depths showing inverse relationship with soil moisture during both the year of study. The linear regression trends also provide evidence in favor of this observation. The linear regression trends indicate **Das** & **Mishra 1982** has also concluded a possible correlation of nematode population with soil moisture. The above findings of present investigations have also been expressed by **Jon's 1959, Prasad** & **Jha 1969** & **Khan et. al. 1971** and **Siddiqui et. al. 1973** (Table No. 23 & 24, Fig No. 91-108).

Table No.-1

Functional Linear Regression depicting correlation of Soil Temperature with *Hoplolaimus johani* associated *with Psidium guajava* at Allahabad during 1997-98

S.N.	H	V	SEX	Y	r	t	p
1	0-10cm	0-10cm	M	30.3578-522X	-0.500061306	-1.915167284	<0.05
2			F	66.2302-1.8096X	-0.586240778	-2.400015069	<0.025
3	10.-1-20.0cm		M	46.4675-1.0748X	-0.545929302	-2.161106627	<0. 05
4	20.1-30.0cm		F	33.246-0.47023X	-0182737695	-061645238	<0. 5
5	0-10cm	10.1-20.0cm	M	48.3822-0.956X	-0.337545568	-1.189313794	<0.05
6			F	59.919-1.273X	-0.449467747	-1.668780491	<0. 1
7			L	52.058-0.652X	-0.186434112	-0.62936636	<0.5
8	10.1-20.0 cm		M	35.9711-0.571X	-0.208113478	-075685526	<0.4
9			F	46.2624-0.901587X	-0.229487256	-0.78199321	<0.4
10			L	42.49-0.353X	-0.069690851	-0.231701757	<0.5
11	20.1-30.0 cm		M	43.285-0.739X	-02401559	-0.820520079	<0.4
12			F	39.1749-0.389X	-0.101476318	-0.33830522	<0.5
13			T	101.99-0.296X	-0.032818512	-0.10895357	<0.5
14	0-10 cm	20.1-30.0 cm	M	14.6287+1.58285X	0.514916674	1.992189987	<0.05
15			F	23.0352-0.057X	-0.031668557	-0.105085429	<0.5
16			L	62.66578-1.4315X	-0.48918933	-.860237441	<0.05
17			T	71.07227+0.094X	0.023172995	0.076876776	<0.5
18	10.1-20.0 cm		M	15.27179+0.44X	0.156582922	0.5258128	<0.5
19			F	32.421185-0.2729X	-0.067177973	-0.223308585	<0.5
20			L	40.2637-0.4626989X	-0.14878112	-0.499005	<0.5
21			T	88.7474 -0.295X	-0.043634432	-0.144857006	<0.5
22	20.1-30.0 cm		L	33.7455-0.503635X	-0.193234588	-0.653197714	<0.5
23			T	61.071-0.04465X	-0.008137549	-0.02690093	<0.5

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-2

Functional Linear Regression depicting correlation of Soil Temperature with *Hoplolaimus johani* associated with *Psidium guajava* at Allahabad during 1998-99

S.N	H	V	SEX	Y	r	t	P
1	0-10cm	0-10cm	M	52.25157-1.46488X	-0.574760916	-2.32948367	<0.025
2			F	62.82369-1.7645X	-0.327392024	-1.14916881	<0.2
3			L	59.61896-1.3171X	-0.190345243	-0.643060693	<0.50
4			T	170.9823-43758X	-0.369403223	-1.318425145	<0. 2
5	10.1-20.0cm		M	63.6074-1.8803X	-0.498045224	-1.904892032	<0.050
6			F	43.14411-0.9315X	-0.181524454	-0.61221966	<0.5
7			T	207.6503-5.7763X	-0.376466504	-1.347751944	<0. 2
8	20.1-30.0cm		M	39.164-0.796598X	-0.248314197	-0.850193468	<0.4
9			F	5.539+0.619960X	0.149974093	0.503097871	<0.5
10			L	64.50935-1.483X	-0.22889451	-0.77986157	<0.4
11	0-10cm	10.1cm-20.0cm	M	45.4735-0.77X	-0.341354274	-0.1204492225	<0.2
12			F	65.3915-1.38978X	-0.447984304	-1.661887038	<0.1
13	20.1-30.0cm		M	41.49539-0.55614X	-0.206207053	-0.698932621	<0.4
14			L	34.7539+0.4963X	0.11261812	0.375903417	<0.5
15			T	136.6715-1.182X	-0.137419108	-0.460132906	<0.5
16	0-10cm	20.1-30.0cm	M	-1.423954+1.124958X	0.417650241	1.524518086	<0.1
17	10.1-20.0cm		L	33.9252-0.1054X	-0.04875744	-0.161902696	<0. 5
18			T	64.84499+0.5449191X	0.101973	0.33994128	<0. 5
19	20.1.30.0cm		M	8.84362+0.5619123X	0.227270422	0.774025661	<0. 4
20			F	18.88603+0.207885X	0.070929042	0.235839012	<0. 5
21			L	24.9661-0.0969X	-0.051752642	-0.171874421	<0. 5

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-3

Functional Linear Regression depicting correlation of Soil Moisture with *Hoplolaimus johani* associated with *Psidium guajava* at Allahabad during 1997-98

S.N.	H	V	SEX	Y	r	t	p
1	0-10cm	0-10cm	M	18.481-0.031X	-0.049384741	-0.163990756	<0.5
2			F	5.33169+0.516113X	0.270568463	0.932142295	<0.2
3			L	23.06875+0.1663316X	0.0763275581	0.253890598	<0.5
4			T	46.90908+0.6505823X	0.168844867	0.56815224	<0.5
5	10.1-20.0cm		F	2.788515+0.675455X	0.436943722	1.611113233	<0.1
6			L	36.30402-0.2518382X	-0.115561464	-0.385859146	<0.5
7			T	52.15508+0.6428095X	0.166825991	0.56116316	<0.5
8	20.1-30.0cm		M	10.558+0.272X	0.21240322	0.720911464	<0.4
9			F	-0.6709213+0.705769X	0.443849431	1.642762818	<0.1
10			T	22.32971+1.453511X	0.303876064	1.057867796	<0.2
11	0-10cm	10.1-20.0cm	M	-6.81+1.01X	0.658877536	2.904950395	<0.01
12			F	6.277651+0.7080902X	0.461766644	1.726611279	<0.1
13			L	4.724419+0.9881593X	0.521539842	2.02730588	<0.05
14	10.1-20.0cm		M	7.892+0.452X	0.304815812	1.061473818	<0.2
15			F	27.36934-0.0732975X	0.034464672	-0.114374336	<0.5
16			L	21.5448+0.3904678	0.142383338	0.47709293	<0.5
17			T	56.77394+0.7700766X	0.132992283	0.445038749	<0.5
18	20.1-30.0cm		M	1.432+0.755X	0.452730239	1.684002112	<0.1
19			F	32.45709-0.0760122X	-0.036623771	-0.121548852	<0.5
20			L	27.51009+0.3606058X	0.162310656	0.545557802	<0.5
21	0-10cm	20.1-30.0cm	M	-7.407+0.919X	0.595182057	2.45468325	<0.5
22			L	45.82173-0.5228218X	-0.355434791	-1.261198756	<0.2
23			T	56.85147+0.4927315X	0.241061183	0.823803529	<0.4
24	10.1-20.0cm		M	15.765+0.301X	0.213668139	0.725409432	<0.4
25			F	1.629334+0.7485003X	0.413118481	1.504594437	<0.1
26			L	24.16549+0.149512X	0.099031649	0.330073371	<0.5
27			T	41.53144+1.199857X	0.35282551	1.250617123	<0.2
28	20.1-30.0cm		M	6.149+0.439X	0.310909108	1.084938803	<0.2
29			F	-4.108854+0.646846X	0.426511584	1.563965605	<0.1
30			T	9.107532+1.521449X	0.551532085	2.192911257	<0.05

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-4

Functional Linear Regression depicting correlation of Soil Moisture with *Hoplolaimus johani* associated with *Psidium guajava* at Allahabad during 1998-99

S.N.	H	V	SEX	Y	r	t	p
1	0-10cm	0-10cm	M	23.739-0.178X	-0.1627796554	-0.547235393	<0.5
2			F	7.984+0.462X	0.200004582	0.677019356	<0.5
3			L	24.964+0.127X	0.0430062	0.142767516	<0.5
4			T	55.791+0.413X	0.081380427	0.270806576	<0.5
5	10.1-20.0cm		M	28.616-0.279X	-0.172737063	-0.581647364	<0.5
6			F	6924.371-0.093X	-0.42601487	-1.56174007	<0.1
7			L	39.536-0.245X	0.07347707	-0.24435639	<0.5
8			T	92.587-0.619X	-0.09461966	-0.313357567	<0.5
9	20.1-30.0cm		M	14.418+0.194X	0.140989586	0.472327599	<0.5
10			F	10.149+0.31X	0.175003255	0.589517656	<0.5
11			L	6.844+0.726X	0.261188239	0.817416387	<0.2
12			T	31.411+1.23X	0.225318372	0.267020279	<0.4
13	0-10cm	10.1-20.0cm	M	-1.644+0.869X	0.662945471	2.936872301	<0.05
14			F	-1.681+1.028X	0.5700303	2.30102502	<0.25
15			L	-2.691+1.309X	0.54305437	2.14494898	<0.05
16			T	-6.083+3.208X	0.360990703	2.679904952	<0.01
17	10.1-20.0cm		M	-4.698+1.026X	0.62849217	2.69758356	<0.1
18			F	4.412+0.935X	0.463815737	1.736367247	<0.1
19			L	22.414+0.569X	0.193520928	0.654203269	<0.5
20			T	22.095+2.531X	0.434741231	1.601093631	<0.1
21	20.1-30.0cm		M	6.089+0.669X	0.426392529	1.56343202	<0.1
22			F	6.089+0.669X	0.426392529	1.56343202	<0.1
23			L	31.89+0.081X	0.043273831	0.143657632	<0.5
24			T	35.86+0.32X	0.125145172	0.518348451	<0.5
25	0-10cm	20.1-30.0cm	M	24.045+0.084X	0.051849401	0.172196627	<0.5
26			F	24.905+0.026X	0.032475551	0.10776606	<0.5
27			L	40.57-0.215X	-0.149979459	-0.503116283	<0.5
28			T	88.963-0.104X	-0.1042716023	-0.14180245	<0.5
29	10.1-20.0cm		M	29.967-0.511X	-0.141294384	-0.473369477	<0.5
30			F	28.551-0.158X	-0.135549811	-0.453755788	<0.5
31			L	45.21-0.427X	-0.327411033	-1.149243541	<0.2
32			T	104.152-0.797X	-0.246799267	-0.844669031	<0.4
33	20.1-30.0cm		M	27.963-0.163X	-0.109242936	-0.364499329	<0.5
34			F	19.385+0.142X	0.080706472	0.268549116	<0.5
35			L	24.955-0.073X	-0.064590353	-0.214670226	<0.5
36			T	72.252-0.093X	-0.032100757	-0.106521063	<0.5

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-5

Functional Linear Regression depicting correlation of Soil Temperature with *Dolicorhynchus allahabadensis* associated With *Psidium guajava* at Allahabad during 1997-98

S.N.	H	V	SEX	Y	R	t	P
1	0-10 cm	0-10 cm	M	25.871-0.543X	-0.308234677	-1.074621728	<0.2
2			F	25.975-0.175X	-0.089759686	-0.298905748	<0.5
3			L	68.647-1.874X	-0.622600078	-2.63875373	<0.01
4	10.1-20.0 cm		L	47.181-1.07X	-0.393387475	-1.419139976	<0.1
5	20.1-30.0 cm		M	18.496-0.142X	-00-.090242594	-0.300527031	<0.5
6			F	35.619-0.702X	-0.29195656	-1.012419903	<0.2
7			L	45.04 –1.01X	-0.329802199	-1.158656941	<0.1
8			T	99.845-1.855X	-0.355360734	-1.260897994	<0.2
9	0-10cm	10.1-20.0cm	M	25.501-0.622x	-0.243192471	-0.831542712	<0.4
10			F	81.354-2.319x	-0.473458269	-1.78275938	<0.1
11			L	55.318-1.427x	-0.420771402	-1.58351068	<0.1
12	10.1-20.0cm		F	20.928+0.102x	-0.031328828	0.1103956999	<0.5
13			L	-1.775+01888x	0.3155477	1.095172969	<0.2
14	20.1-30.0cm		F	30.612-0.45x	-0.166279322	-0.55927192	<.05
15			L	-10.406+1.36x	0.377606477	1.352510538	<0.2
16			T	34.342+0.876x	0.149199144	0.50043891	<0.5
17	0-10cm	20.1-30.0cm	M	-3.638+0.673x	0.47709059	1.800446848	<0.05
18			F	-2.38+0.69x	0.279109729	0.964012876	<0.2
19			L	-24.512+1.752x	0.581715796	2.371959352	<0.025
20	10.1-20.0cm		L	-11.21+1.371x	0.526442581	2.053623354	<0.05
21			T	30.745+0.803x	0.213523473	0.724894819	<0.4
22	20.1-30.0CM		M	-2.133+0.506x	0.2688498	0.92575838	<0.2
23			L	-7.931+1.13x	0.456534785	1.70186038	<0.1
24			T	-23.523+2.788x	0.622323309	2.636839012	<0.01

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-6

Functional Linear Regression depicting correlation of Soil Temperature with *Dolicorhynchus allahabadensis* associated with *Psidium guajava* at Allahabad during 1998-99

S.N.	H	V	SEX	Y	r	t	P
1	0-10cm	0-10cm	M	20.3191-0.238X	-0.075783528	-.252070409	<0.5
2			L	95.781-2.931X	-0.523427531	-2.03740563	<0.05
3			T	160.1559-4.123X	-0.440147738	1.625753041	<0.1
4	10.1-20.0cm		M	35.2905-0.827X	-0.3293870292	1.157020985	<0.1
5			L	49.996-1.1075X	-0.252150448	0.864212834	<0.4
6			T	135.4775-3.182X	-0.476483364	1.797482056	<0.1
7			M	10.3325+0.257X	0.096001319	0.319877806	<0.5
8			F	37.5805-0.732X	-0.175084553	-0.58980177	<0.5
9			L	80.629-2.335X	-0.449113197	-1.667131357	<0.5
10			T	128.5409-2.81X	-0.343508432	1.213106615	<0.2
11	0-10cm	10.1-20.0cm	M	29.947-0.43087X	-0.284192979	-.983097441	<0.2
12			F	67.9166-1.651X	-0.38403335	-1.379473641	<0.1
13			L	68.87689-1.615X	-0.600294929	-2.489379879	<0.025
14			T	166.1426-3.823X	-0.479979906	-1.814602177	<0.050
15	10.1-20.0cm		F	22.5545+0.17X	0.075789681	0.252090995	<0.5
16			L	12.111+0.5657X	0.277757382	0.958950519	<0.2
17			T	67.888+0.24X	0.053507354	0.177718409	<0.5
18	20.1-30.0cm		M	9.272+0.411X	0.348297562	1.232336268	<0.2
19			F	27.76 – 0.247 X	-0.10714432	-0.357414975	<0.5
20			L	8.1978+0.8297 X	0.338562397	1.193359553	<0.2
21			T	45.234+0.9936 X	0.207227396	0.702545822	<0. 4
22	-10.0cm	20.1-30.0cm	F	14.875+0.1609 X	0.096307649	0.320908043	<0. 5
23			T	31.143+1.167 X	2.304682195	1.060960891	<0. 2
24	10.1-.20.cm		M	4.286+0.415X	0.173751533	0.585169348	<0. 5
25			F	24.591-0.095X	-0.0541 43724	-0.179838215	<0. 5
26			L	3.644+0.7936X	0.289350195	1.002551883	<0. 2
27			T	30.521+1.1114X	0.235557396	0.803876225	<0.4
28	20.1-30.0cn		M	1.359+0.658X	0.421528607	1.541716964	<0. 1
29			F	-0.537+0.808X	0.439666234	1.623548063	<0. 1
30			L	-2.49195+0.9346X	0.311787674	1.08833423	<0. 2
31			T	-4.3878+2.4X	0.464109546	1.737769009	<0. 1

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-7

Functional Linear Regression depicting correlation of Soil Moisture with *Dolicorhynchus allahabadensis* associated with *Psidium guajava* at Allahabad during 1997-98

S.N.	H	V	SEX	Y	r	t	p
1	0-10cm	0-10cm	F	15.51645+0.194X	0.603152544	0.548464732	<0.5
2			L	17.06321+0.1717786X	0.0934482442	0.311409872	<0.5
3			T	36.69077+0.631X	0.210339519	0.71358122	<0.4
4	10.1-20.0cm		M	6.460403+0.296X	0.310489683	1.083318923	<0.2
5			F	28.09678-0.282X	-0.295819955	1.027092649	<0.2
6	20.1-30.0cm		M	7.964152+0.222X	0.231122218	0.787877686	<0.4
7			F	7.853366+0.331X	0.225382986	0.767252005	<0.4
8			L	30.35387-0.3008062X	-0.160785423	0.540294483	<0.5
9			T	46.17139+0.2526156X	0.079214074	0.263551538	<0.5
10	0-10cm	10.1-20.0cm	M	-0.96950+0.365X	0.263468163	0.905829737	<0.2
11			F	-4.047035+0.9501532X	0.358200138	1.2724	<0.2
12			L	2.465525+0.7465488X	0.406398234	1.475184725	<0.1
13			T	-7.48206+2.061832X	0.404019598	1.464860273	<0.1
14	10.1-20.0cm		M	-21.12646+1.22X	0.211503212	3.358256453	<0.005
15			F	11.10636+0.3782514X	0.212810342	0.72235875	<0.4
16			L	21.72614-0.7917935X	-0.051625292	-0.171450348	<0.5
17	20.1-30.0cm		M	24.09775-0.333X	-0.277896323	-0.959470342	<0.2
18			F	18.88846+0.03438647 X	0.023425613	0.077715295	<0.5
19			L	-0.2424412+0.677776X	0.347455077	1.228945577	<0.2
20			T	4274377+0.379X	0.119166882	0.398068378	<0.5
21	0-10cm	20.1-30.0cm	M	8.75698+0.111899X	0.157674878	0.529572794	<0.5
22			F	22.37615-0.2454253X	-0.197236883	-0.667268855	<0.5
23			L	22.71618-0.1556293X	-0.105998372	-0.353548614	<0.5
24			T	54.07466-0.296203X	-0.125420487	-0.419283496	<0.5
25	10.1-20.0cm		M	24.56278-0.385534X	-0.342332057	-.208399662	<0.2
26			T	59.75072-0.2915014X	-0.15403354	-0.517042035	<0.5
27	20.1-30.0cm		M	5.407723+0.137X	0.1545089207	0.486352767	<0.5
28			F	-5.114597+0.5764205X	03390079814	1.195133928	<0.2
29			L	14.2913+0.1457507X	0.117137749	0.391195077	<0.5
30			T	14.58443 +0.8594589X	0.381579079	1.609306674	<0.1

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-8

Functional Linear Regression depicting correlation of Soil Moisture with *Dolicorhynchus allahabadensis* associated with *Psidium guajava* at Allahabad during 1998-99

S.N.	H	V	SEX	Y	r	t	p
01	0-10cm	0-10CM	M	6.17+0.27X	-0.20037295	-0.678318397	<0.5
02			F	14.461+0.232X	0.158990711	0.5341066	<0.5
03			L	20.488+0.218X	0.090834944	0.30251604	<0.5
04			T	41.087+0.721X	0.179542612	0.605311673	<0.4
05	10.1-20.0cm		M	8.055+0.25X	0.232864178	0.794155008	<0.4
06			F	33.985-0.406X	-0.4154436904	-1.514748257	<0.1
07			L	12.09+0.38X	0.202020469	0.684132008	<0.5
08			T	54.132+0.224X	0.078387471	0.260784271	<0.5
09	20.1-30.0cm		M	9.755+0.207X	0.80339105	0.608087039	<0.5
10			F	-0.633+0.665X	0.370841079	1.324373384	<0.2
11			L	51.081-0.784X	0.351490244	1.245216606	<0.2
12			T	60.204+0.088X	0.025070932	0.083840974	<0.5
13	0-10cm	10.1-20.0cm	M	12.11+0.122X	0.107818646	0.359690783	<0.5
14			F	10.47+0.565X	0.22598109	0.769458562	<0.4
15			L	13.742+0.509X	0.325592992	1.142102952	<0.2
16			T	35.766+1.2X	0.259040309	0.889501293	<0.2
17	10.1-20.0cm		M	13.188+0.25X	0.199442595	0.6750381	<0.5
18			F	16.475+0.304X	0.232745794	0.793728149	<0.4
19			L	24.27+0.037X	0.031643353	0.105001711	<0.5
20			T	53.833+0.594X	0.227088378	0.77337195	<0.4
21	20.1-30.0cm		M	27.877-0.267X	0.390334817	1.406138947	<0.1
22			F	20.819+0.033X	0.0246694719	0.081928105	<0.5
23			L	19.122+0.262X	0.183959461	0.620717783	<0.5
24			T	67.853+0.027X	0.009831826	0.032610053	<0.5
25	0-10cm	20.1-30.0cm	M	4.496+0.295X	0.313729578	1.095850168	<0.2
26			F	14.348+0.138X	0.137526258	0.460498598	<0.5
27			L	22.168+0.082X	0.049958762	0.165901633	<0.5
28			T	38.091+0.669X	0.289010336	1.001266934	<0.2
29	10.1-20.0cm		M	-4.285+0.578X	0.400668055	1.450373097	<0.1
30			F	18.61+0.112X	0.106336308	0.354688641	<0.5
31			L	14.424+0.269X	0.162631256	0.546664646	<0.5
32			T	28.066+0.98X	0.320724041	1.12304897	<0.2
33	20.1-30.0cm		M	-1.384+0.499X	0.529397054	2.069619072	<0.5
34			F	8.706+0.327X	0.294553892	1.022278248	<0.2
35			L	6.688+0.425X	0.23487808	0.801422382	<0.4
36			T	13.976+1.252X	0.400574013	1.449067602	<0.1

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-9

Functional Linear Regression depicting correlation of Soil Temperature with *Hoplolaimus johani* associated with *Zyzyphus jujuba* at Allahabad During 1997-98

S.N.	H	V	SEX	Y	r	t	p
1	0-10cm	0-10CM	L	5.3419+0.15532X	0.065858835	0.218904298	<0.5
2			T	37.434 –0.3831X	0.068313698	-0.2271101441	<0.5
3	10.1-20.0cm		M	450297-1.2838X	-0.350733245	-1.242158168	<0.2
4			L	11.2588+0.006X	-0.002812505	0.009328062	<0.5
5			T	67.3017-1.2880X	-0.173255034	-0.583445391	<0.5
6	20.1-30.0cm		M	46.0205-1.4154X	-0.407508433	-1.480015807	<0.1
7			F	17.249-0.2944X	-0.153799476	-0.516237306	<0.5
8			L	3.9024+0.3728X	0.131818866	0.441042335	<0.5
9			T	67.17139-1.33691X	-0.182474715	-0.615534656	<0.5
10	0-10.cm	10.1-20.0cm	F	51.3565-1.672x	-0.557795909	-2.22897404	<0.025
11			L	64.422-1.99666x	-0.396070985	-1.430614669	<0.1
12			T	171.0891-5.442x	-0.484250445	-1.83566466	<0.05
13	10.1-20.0cm		M	72.329-2.3637x	-0.488579029	-1.85718835	<0.05
14			F	46.3095-1.46x	-0.470501374	-1.768447221	<0.1
15			L	47.04401.49657x	-0.558135127	-2.230942624	<0.025
16	20.1-30.0cm		M	435.23-1.546x	-0.357326221	-1.268889548	<0.2
17			F	39.381-1.2176x	-0.434041088	-1.597915973	<0.1
18			L	68.190-2.13879x	-0.442819019	-1.638017502	<0.1
19			T	157.1035-4.902x	-0.467831527	-1.755590217	<0.1
20	0-10cm	20.1-30.0cm	M	43.5451-1.305x	-0.467831527	-1.733390217	<0.1
21			F	32.286-0.93966x	-0.376190701	-1.346628287	<0.2
22			L	28.6541-0.73x	-0.8971518	-0.640852484	<0.5
23	10.1-20.0cm		M	44.952-1.36x	-0.429364753	-1.576782905	<0.1
24			F	33.6078-0.925x	-0.326076314	-1.14999876	<0.2
25			L	42.9805-1.184x	-0.263750222	-0.906871944	<0.2
26			T	121.541-3.469x	-0.350855847	-1.242653319	<0.2
27	20.1-30.0cm		M	41.783-1.266x	-0.375008919	-1.34167792	<0.2
28			F	29.394-0.8469x	-0.347808269	-1.230366632	<0.2
29			L	36.9960-1.05589x	-0.291558289	-1.01091041	<0.2
30			T	108.168-3.1689x	-0.380129679	-1.363068724	<0.2

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-10

Functional Linear Regression depicting correlation of Soil Temperature with *Hoplolaimus johani* associated with *Zyzyphus jujuba* at Allahabad during 1998-99

S.N.	H	V	SEX	Y	r	t	p
1	0-10cm	0-10cm	F	7.6913+0.17758X	0.038264234	0.127001118	<0.5
2			T	18.9851+0.4615X	0.041955191	0.139272257	<0.5
3	10.1-20.0cm		M	12.429-0.090X	-0.02386482	-0.079173202	<0.5
4			L	5.8886-0.12268X	0.029810202	0.098913214	<0.5
5			T	12.8964-0.72255X	0.066271554	0.220282145	<0.5
6	20.1-30.0cm		M	5.808+0.094X	0.028623478	0.09497225	<0.5
7			F	2.05398+0.39782X	0.082013572	0.272927684	<0.5
8			L	-4.5512+0.6203X	0.168505588	0.566977189	<0.5
9			T	6.02308+1.0244X	0.090886725	0.30268993	<0.5
10	0-10cm	10.1-20.0cm	M	1.708+0.315X	0.122362723	0.408903972	<0.5
11			L	-14.86284+1.18435X	0.353035394	1.251468009	<0.2
12	10.1-20.0cm		M	-12.357+0.092X	0.346103569	0.223513314	<0.2
13			F	3.9106+0.3172X	0.097120802	0.323643253	<0.5
14			T	-31.2554+2.65164X	0.318814725	1.115604343	<0.2
15	20.1-30.0cm		M	-11.561+0.883X	0.340313571	1.20033826	<0.2
16			L	-11.5175+1.01131X	0.304025467	1.058440859	<0.2
17			T	-33.07726+2.823687X	0.336598033	1.185547971	<0.2
18	0-10cm	20.1-30.0cm	M	-34.703+1.966X	0.446167753	1.65346903	<0.1
19			F	2.2622+0.365X	0.108236643	0.36110175	<0.5
20			L	-36.2189+1.8551X	0.63984098	2.76134315	<0.01
21			T	-68.6567+4.1866X	0.421586009	1.5419722884	<0.1
22	10.1-20.0cm		M	-36.215+1.936X	0.534420839	2.097059327	<0.05
23			F	-19.9546+1.3328X	0.385233354	1.384533943	<0.1
24			L	-22.1656+1.537895X	0.370154801	1.321532963	<0.2
25			T	-78.33165+4.806843X	0.441412638	1.63155377	<0.1
26	20.1-30.0cm		M	-26.392+1.557X	0.477286215	1.801403221	<0.05
27			F	-12.4821+0.9851X	0.321522276	1.126165893	<0.2
28			L	7.6647+0.1966X	0.055481247	0.184294342	<0.5

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-11

Functional Linear Regression depicting correlation of Soil Moisture with *Hoplolaimus johani* associated with *Zyzyphus jujuba* at Allahabad during 1997-98

S.N.	H	V	SEX	Y	r	t	p
1	0-10CM	0-10CM	M	26.9148-0.5897213X	-0.570151627	-2.30175032	<0.025
2			F	37.7444-0.8570288X	-0.638336842	-2.750378855	<0.01
3			L	37.64463-0.899776X	-0.617493794	-2.603684673	<0.01
4			T	101.8272-2.332613X	-0.673166961	-3019162718	<0.01
5	10.1-20.cm		M	41.18366-0.8773142X	-0:38782758	-1.395777845	<0.1
6			F	43.17641-1.024531X	-0.677456587	-3.054626248	<0.01
7			L	42.08657-0.9690332X	-0.686513191	-3.131415692	<0.005
8	20.1-30.0CM		M	27.5656-0.5181338X	-0.241423562	-0.82511851	<0.4
9			F	34.67467-0.7796105X	-0.659201292	-2.907474297	<0.01
10			T	120.2522-2.717288X	-0.600215026	-2.488861908	<0.025
11	0-10cm	10.1-20.0cm	M	15.10589-0.04967945X	-0.024611066	-0.081650405	<0.5
12			F	15.6652-115964X	-0.071669308	-0.2383104	<0.5
13			L	34.50961-0.5313618X	-0.195007788	-0.659427557	<0.5
14			T	65.2807-0.697X	-0114565812	-0.38249026	<0.5
15	10.1-20.0cm		M	16.86853-0.00882287X	-0.003366565	-0.011165696	<0.5
18			F	9.578069+0.06976841X	0.041470855	0.137661695	<0.5
17			L	17.707-0.1842845X	-0.126951245	-0.424484167	<0.5
18			T	61.82157-0.925X	-0.204894658	-0.694288706	<0.5
19	20.1-30.0cm		M	20.29228-2230145X	-.113352709-	-0.3788714	<0.5
20			F	13.38117-0.08392541	-0.055289765	-0.183656338	<0.5
21			L	34.65277-0.522901X	-0199982428	-0.676941243	<0.5
22			T	68.3262-0.8298909X	-0.146301584	-0.49050528	<0.5
23	0-10cm	20.1-30.0cm	M	14.78204-0.07569635X	-0.047845471	-0.158867421	<0.5
24			F	-5.08682+0.4435511X	0.353292783	1.252510492	<0.2
25			T	-7.6212+1.216877X	0.27699378	0.956094793	<0.2
26	10.1-20.0cm		M	13.76763-0.0428789X	-0.026930833	-0.089351876	<0.5
27			F	4.334985+0.2123974X	0.140491361	0.470624834	<0.5
28			T	12.71095+0.7659905X	0.154103872	0.517283859	<0.5
29	20.1-30.0cm		M	29.41147-0.537961X	-0.316973995	-1.108441449	<0.2
30			F	-011174+0.4213605X	0.344354563	1.216496185	<0.2
31			L	3.406863+0.2469299X	0.135636195	0.45405038	<0.5
32			T	27.80715+0.1303293X	0.031101712	0.103202637	<0.5

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-12

Functional Linear Regression depicting correlation of Soil Moisture with *Hoplolaimus johani* associated with *Zyzyphus jujuba* at Allahabad during 1998-99

S.N.	H	V	SEX	Y	r	t	p
01	0-10cm	0-10cm	M	-19.642+0.917X	0.568388385	2.291227256	<0.025
02			F	-23.061+1.098X	0.551921429	2.195137085	<0.05
03			L	-17.039+0.801X	0.638855558	2.754153954	<0.01
04			T	-59.774+2.817X	0.596915047	2.467571070	<0.025
05	10.1-20.0cm		M	-21.005+0.986X	0.608045303	2.540184163	<0.025
06			F	-18.196+0.908X	0.568802521	2.293694692	<0.025
07			L	-18.866+0.869X	0.493047743	1.879597851	<0.05
08			T	-58.121+2.765X	0.591182053	2.431043175	<0.025
09	20.1-30.0cm		M	-16.979+0.786X	0.557412763	2.226752475	<0.025
10			F	-32.558+1.381X	0.663860134	2.944113256	<0.01
11			L	-27.526+1.178X	0.746346158	3.719210469	<0.001
12			T	-80.017+3.459X	0.715564498	3.39742362	<0.005
13	0-10cm	10.1-20.0cm	M	-11.288+0.615X	0.410029465	1.491015486	<0.1
14			F	-1.886+0.405X	0.209725266	0.711401329	<0.4
15			L	9.935+0.097X	0.050143489	0.166516612	<0.5
16			T	-3.296+1.119X	0.219482645	0.746135036	<0.4
17	10.1-20.0cm		M	3.824+0.168X	0.108920963	0.363412118	<0.5
18			F	-8.041+0.585X	0.308326163	1.074974182	<0.2
19			L	9.271+0.052X	0.032916039	0.10922934	<0.5
20			T	5.166+0.792X	0.163688505	0.550315974	<0.5
21	20.1-30.0cm		M	6.238+0.093X	0.062196429	0.20668237	<0.5
22			F	-12.821+0.739X	0.416216345	1.518185038	<0.1
23			L	7.523+0.147X	0.076048066	0.252955421	<0.5
24			T	-5.717+1.187X	0.243412985	0.832344174	<0.4
25	0-10cm	20.1-30.0cm	M	-30.052+1.345X	0.505287186	1.941996155	<0.05
26			F	-16.83+0.864X	0.423874037	1.552167729	<0.1
27			L	-19.515+0.089X	0.508142636	1.956776307	<0.05
28			T	-66.42+3.1X	0.516665281	2.001413166	<0.05
29	10.1-20.0cm		M	-14.395+0.794X	0.362825433	1.29135228	<0.2
30			F	-27.145+1.23X	0.474696524	1.788775874	<0.1
31			L	-24.412+1.233X	0.491272695	1.870673148	<0.05
32			T	-64.967+3.227X	0.490396366	1.86627843	<0.05
33	20.1-30.0cm		M	-21.922+1.041X	0.528270775	2.063509072	<0.05
34			F	-19.19+0.962X	0.519773092	2.017890123	<0.05
35			L	-18.31+0.948X	0.443297933	1.640222018	<0.1
36			T	-43.075+2.438X	0.433835942	1.596985573	<0.1

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-13

Functional Linear Regression depicting correlation of Soil Temperature with *Dolicorhynchus allahabadensis* associated with *Zyzyphus jujuba* at Allahabad during 1997-98

S.N.	H	V	SEX	Y	r	t	p
1	0-10cm	0-10cm	L	-3.437+0.478X	0.254133721	0.871477601	<0.4
2			T	6.168+0.538X	0.13791537	0.461826743	<0.5
3	10.1-20.0cm		M	5.5457+0.0286X	0.020892013	0.069306098	<0.5
4			F	3.538+0.0997X	0.075923591	0.252538983	<0.5
5	20.1-30.0cm		M	-6.39+0.509	0.3401+9788	1.199876358	<0.2
6	0-10cm	10.1-20.0cm	M	16.41115-0.4485x	-0.25973728	-0.892068379	<0.2
7			F	58.3804-1.977x	0.450852055	-1.67522887	<0.1
8			T	100.149-3.176x	-0.44693395.9	-1.657016583	<0.1
9	20.1-30.0cm		M	20.9532-0.584x	-0.268789237	-0.92553595	<0.2
10			F	46.07817-1.54x	-0.433479988	-1.595371947	<0.1
11			L	45.82-1.579X	-0.504005281	-1.935388797	<0.05
12			T	112.851-3.704X	-0.509575417	-1.964225245	<0.05
13	0-10cm	20.1-30.0cm	M	19.75-0.60396X	-0.360346294	-1.381206708	<0.2
14			F	19.0309-0.529X	-0.224330227	-0.763477811	<0.4
15			L	17.908-0.441X	-0.196060734	-0.663130085	<0.5
16			T	56.421-1.564X	-0.28839111	-0.998941925	<0.2
17	10.1-20.0cm		M	20.9764-0.645X	-0.397853096	-1.438258965	<0.1
18			F	17.9069-0.4200X	-0.198826427	-0.672866628	<0.5
19			L	16.722-0.329X	-0.135099381	-0.452219886	<0.5
20			T	58.711-1.524X	-0.265644059	-0.913876169	<0.2
21	20.1-30.0cm		M	18.42395-0.518X	-0.292542824	-1.014642955	<0.2
22			F	21.066-0.6X	-0.301161703	-1.047471229	<0.2
23			L	28.926-0.897X	-0.428410906	-1.572491535	<0.1
24			T	68.402-2.015X	-0.37385297	-1.336869108	<0.2

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-14

Functional Linear Regression depicting correlation of Soil Temperature with *Dolicorhynchus allahabadensis* associated with *Zyzyphus jujuba* at Allahabad during 1998-99

S.N.	H	V	SEX	Y	r	t	p
1	0-10cm	0-10cm	M	-12.7429+0.7928X	0.321033177	1.124255759	<0.2
2			F	5.6166+0.1236X	0.035526405	0.117902183	<0.5
3			L	-8.0233+0.7834X	0.171308623	0.576691417	<0.5
4			T	-15.1495+1.6999X	0.172584025	0.581116224	<0.5
5	10.1-20.0cm		F	0.2674+0.28865X	0.083896641	0.279238144	<0.5
6			L	-15.1677+1.050X	0.268697903	0.925194622	<0.2
7			T	-17.3326+1.883X	0.159185843	0.534778876	<0.5
8	20.1-30.0cm		M	-13.63138+0.8917X	0.256694936	0.880876789	<0.2
9			F	8.86498+0.02008X	0.003211346	0.010650886	<0.5
10			L	-39.0757+2.011X	0.393185315	1.418277284	<0.1
11			T	-43.84213+2.923X	0.218336297	0.742042398	<0.4
12	0-10cm		M	-11.3444+0.7646X	0.422770217	1.547244614	<0.1
13			T	-20.906+2.017X	0.286311239	0.991076728	<0.2
14	10.1-20.0cm		M	-9.9915+0.7694X	0.31423246	1.097799003	<0.2
15			F	-22.3023+1.4529X	0.402249766	1.457201396	<0.1
16			L	-2.6517+0.59795X	0.171550504	0.577530356	<0.5
17			T	-94.9455+2.8146X	0.57697174	2.34290263	<0.025
18	20.1-30.0cm		M	-6.4682+0.5198X	0.328703931	1.154330256	<0.1
19			F	14.5348+1.0649X	0.373069657	1.333614599	<0.2
20			L	-7.9044+0.60159X	0.416987547	1.521589476	<0.1
21			T	-28.907+2.18623X	0.379042609	1.358515612	<0.2
22	0-10cm	20.1-30.0cm	M	2.2839+0.0969X	0.063180195	0.209964484	<0.5
23			F	-8.6867+0.7664X	0.238354043	0.813991524	<0.4
24			L	28.1415+1.5843X	0.48550489	1.841884034	<0.05
25			T	-34.5444+2.448X	0.337697042	1.18991618	<0.2
26	10.1-20.0cm		F	-17.5619+1.1136X	0.39094137	1.408717831	<0.1
27			L	-15.5193+1.1017X	0.277455521	0.95782138	<0.2
28	20.1-30.0cm		M	-8.899+0.67X	0.252717519	0.866288833	<0.4
29			F	-29.1448+1.625X	0.437192757	1.612248392	<0.1
30			L	-25.9784+1.4558X	0.42905023	1.575367146	<0.1
31			T	-64.0244+3.75099X	0.400489226	1.44962063	<0.1

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-15

Functional Linear Regression depicting correlation of Soil Moisture with *Dolicorhynchus allahabadensis* associated with *Zyzyphus jujuba* at Allahabad during 1997-98

S.N.	H	V	SEX	Y	r	t	p
1	0-10CM	0-10CM	M	14.3831-0.32X	-0.567132517	-2.283760461	<0.025
2	20.1-30.0cm		L	41.29416-1.004555X		-2.588427385	>0.025
3	0.10cm	10.1-20.0cm	F	10.55216+0.037056X	0.015608078	0.051772445	<0.5
4			L	16.70527-0.2796165X	-0.280084753	-0.967666624	<0.2
5			T	44.81755-0.6053381X	-0.157336207	-0.528406418	<0.5
6	10.1-20.0cm		M	17.90483-0.337X	-0.309382577	-1.079046479	<0.2
7			F	16.31948-0.2934615X	-0.290531509	- 1.0070211449	<0.2
8			L	18.616-0.246X	-0.160665932	-0.539882311	<0.5
9			T	52.85899-0.8773087X	-0.275294019	-0.949745041	<0.2
10	20.1-30.0cm		M	25.90787-0.57977449X	-0.492390274	-1.876288585	<0.025
11			T	37.32624-0.3658542X	-0.092970846	-0.309690737	<0.5
12	0-10cm	20.1-30.0cm	M	3.881755+0.04X	0.04939228	0.164019005	<0.5
13			L	-0.3540096+2298159X	0.202988788	0.682551746	<0.5
14	10.1-20.0cm		M	2.51867+0.089X	0.109336742	0.364818108	<0.5
15			F	3.429781+0.1316458X	0.123984559	0.414407774	<0.5
16			L	1.22148+0.2275591X	0.185869294	0.627391332	<0.5
17			T	7.169428+0.448348X	0.155467384	0.521973646	<0.5
18	20.1-30.0cm		M	-5.637957+0.347921X	0.390856467	1.408356716	<0.1
19			F	8.255209-0.062X	-0.062292757	-0.207003722	<0.5
20			L	8.577318-0.346981X	-0.032957561	-0.109367278	<0.5
21			T	11.69457+0.2507852X	0,092542637	0.308252002	<0.5

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-16

Functional Linear Regression depicting correlation of Soil Moisture with *Dolicorhynchus allahabadensis* **associated with** *Zyzyphus jujuba* **at Allahabad during 1998-99**

S.N.	H	V	SEX	Y	r	t	P
01	0-10cm	0-10cm	M	-17.163+0.721X	0.686414796	3.130566947	<0.005
02			F	-23.82+1.017X	0.682325223	3.095575662	<0.01
03			L	-25.375+1.121X	0.571437845	2.309456728	<0.025
04			T	-66.613+2.861X	0.678607074	3.064234824	<0.01
05	10.1-20.0CM		M	-20.712+0.872X	0.591002419	2.429907891	<0.025
06			F	-21.654+0.899X	0.609446593	2.549491074	<0.025
07			L	-20.190+0.929X	0.554477601	2.209801904	<0.025
08			T	-71.235+3.078X	0.606613539	2.530713758	<0.025
09	20.1-30.0cm		M	-39.798+1.546X	0.577972719	2.349003556	<0.025
10			F	-22.834+0.944X	0.63365612	2.716596796	<0.01
11			L	-30.875+1.218X	0.555013978	2.21289053	<0.025
12			T	-93.539+3.709X	0.645755452	2.804982692	<0.01
13	0-10cm	10.-20.0cm	M	-4.413+0.441X	0.285417247	0.987707221	<0.2
14			F	-5.319+0.363X	0.345484778	1.221029031	<0.2
15			L	-0.64+0.315X	0.177852675	0.599427183	<0.5
16			T	-10.44+1.121X	0.273565984	0.943299547	<0.2
17	10.1-20.0cm		M	-3.843+0.479X	0.228311206	0.777764789	<0.4
18			F	-4.319+0.373X	0.264124328	0.90825465	<0.2
19			L	-7.053+0.558X	0.275311205	0.949809193	<0.2
20			T	-12.357+1.324X	0.245461057	0.83979452	<0.4
21	20.1-30.0cm		M	-9.25+0.599X	0.360957908	1.283706749	<0.2
22			F	-6.369+0.367X	0.399316289	1.444549728	<0.1
23			L	2.077+0.128X	0.15255233	0.154359041	<0.5
24			T	-13.077+1.08X	0.322661157	1.130617593	<0.2
25	0-10cm	20.1-30.cm	M	-20.384+0.94X	0.483834951	1.833607958	<0.05
26			F	-11.064+0.484X	0.523100329	2.035652152	<0.05
27			L	-21.797+1.004X	0.509150857	1.962015689	<0.05
28			T	-53.244+2.428X	0.554457367	2.209685469	<0.025
29	10.1-20.0		M	-18.312+0.866X	0.503607593	1.933342473	<0.05
30			F	-13.612+0.606X	0.525572953	2.048934806	<0.05
31			L	-27.579+1.205X	0.502572085	1.928021933	<0.05
32			T	-59.567+2.679X	0.554017103	2.207153385	<0.025
33	20.1-30.0cm		M	-20.204+0.955X	0.425154854	1.557890834	<0.1
34			F	-16.532+0.742X	0.463571013	1.735200229	<0.1
35			L	-21.107+0.952X	0.464404126	1.739175181	<0.1
36			T	-57.875+2.65X	0.467425719	1.753641399	<0.1

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-17

Functional Linear Regression depicting correlation of Soil Temperature with *Hoplolaimus johani* associated with *Carrica papaya* at Allahabad during 1997-98

S.N	H	V	SEX	Y	r	t	p
1	0-10cm	0-10cm	M	15.53849-0.2282975	-0.1093924	0.365010559	<0.5
2			F	43.2667-1.171411X	-0.311702639	-1.08800546	<0.2
3			L	33.63979-0.5809727	-0.123206555	-0.411767151	<0.5
4	20.1-30.0cm		M	14.75952-9.852522x	-0.03868626	-0.128361382	<0.5
5			F	17.53043-0.299036x	-0.13351678	-0.442856746	<0.5
6			L	45.61743-1.273804x	-0.3182588	-1.112457368	<0.2
7			T	77.90736-1.671365	-0.204738	-0.721503554	<0.4
8	0-10cm	10.-20.0cm	M	50.84193-10576336x	-0.4675571	-1.754250042	<0.1
9			F	71.48618-20289166x	-0.4621185	-1.72823521	<0.1
10			L	77.53312-2.372429x	-0.4062333	-1.475832684	<0.1
11			T	199.8612-6.237932x	-0.4540018	-01.689929123	<0.1
12	10.1-20.0cm		M	68.89555-2.235854x	-0.5392008	-20123435644	<0.05
13			F	94.17737-3.148864	-0.6615418	-2.92567821	<0.01
14			L	88.69024-2.870258x	-0.4797783	-1.813592765	<0.05
15			T	251.7632-8.254976x	-0.592079	-2.439026031	<0.025
16	20.1-30.0cm		M	76.38268-2.482658x	-0.5479156	-2.072263897	<0.2
17			F	87.21612-2.88549x	-0.297103	-2.071257465	<0.05
18			L	101.4946-3.33546x	-0.4687494	-1.759949257	<0.1
19			T	265.099-8.704x	-0.525041216	-2.046072358	<0.05
20	0-10cm	20.1-30.cm	M	27.74451-0.6147816	-0.1414713	-0.473950797	<0.5
21			F	40.81966-1.198179	0.3640528	-1.296355747	<0.2
22			L	52.16511-1.507927x	-0.3263719	-1.145135216	<0.2
23	10.1-20.0cm		M	40.46303-1.14.613x	-0.2785069	-0.966442602	<0.2
24			F	46.78222-10391197x	-0.3215798	-1.12359019	<0.2
25			L	52.66529-1.487087x	-0.3143842	-1.099924701	<0.2
26			T	139.9105-4.019897x	-0.3153189	-1.118491327	<0.2
27	20.1-30.0cm		M	33.27618-1.067805x	-0.2576804	-0.884454309	<0.2
28			T	122.837-3.44x	-0.282688609	-0.977440137	<0.2

Where: **H = Horizontal Distance in "cm" From the Plant Stem**

V = Vertical Depth in "cm" in Soil

M = Male

F = Female

L = Larva

T = Total

Note: Only Significant Level Shown in the Table.

Table No.-18

Functional Linear Regression depicting correlation of Soil Temperature with *Hoplolaimus johani* associated with *Carrica papaya* at Allahabad during 1998-99

S.N	H	V	SEX	Y	r	t	p
01	0-10cm	0-10cm	M	0.3589+0.363X	0.10798163	0.360240921	<0.5
02			F	-5.872+0.82X	0.144270261	0.483549061	<0.5
03			T	-11.492+2.0575X	0.151621924	0.508754972	<0.5
04	10.1-20.0cm		M	-8.215+0.7376X	0.196103743	0.66328137	<0.5
05			L	-20.7681+1.426X	0.308275177	1.074777753	<0.2
06	20.1-30.0cm		M	-20.126+1.3595X	0.217535508	0.739178235	<0.4
07			F	-31.8699+1.856X	0.356450942	1.265328339	<0.2
08			T	-77.085+4.841X	0.267052891	0.919094013	<0.2
09	0-10cm	10.1-20.0cm	M	-1.52587+0.491X	0.178974883	0.603334184	<0.5
10			F	-23.4689+1.6145x	0.470986045	1.770787885	<0.1
11			L	0.4432+0.562x	0.177096594	0.596796229	<0.5
12	10.1-20.0cm		M	-12.686+0.948X	0.4068161668	1.477004693	<0.1
13			F	-10.475+1.03X	0.337868542	1.190598332	<0.2
14			L	-32.733+2.105X	0.430844252	1.583451997	<0.1
15			T	-55.8943+4.083X	0.412228192	1.500642419	<0.1
16	20.1-30.0cm		M	-12.2457+0.936X	0.3326643566	1.169875218	<0.2
17			F	-34.183+2.053X	0.551573011	2.193145127	<0.05
18			L	-40.7866+2.526X	0.459329487	1.715053404	<0.1
19			T	-87.215+5.516X	0.470997951	1.770845412	<0.1
20	0-10cm	20.1-30.0cm	M	-39.565+2.018X	0.702332656	3.27228705	<0.005
21			F	-15.511+1.0174X	0.437157384	1.613087128	<0.1
22			L	10.111+0.07X	0.020037207	0.066469244	<0.5
23			T	-44.5404+3.088X	0.406829399	1.477060028	<0.1
24	10.1-20.0cm		M	-26.398+1.493X	0.55473482	2.211282558	<0.025
25			F	-7.357+0.648X	0.343168419	1.21174548	<0.2
26			T	-59.6471+3.722X	0.499077264	1.910146812	<0.05
27	20.1-30.0cm		M	-27.258+1.484X	0.577319645	2.345021297	<0.025
28			F	11.449-0.058X	-0.020835953	-0.069120043	<0.5
29			L	-10.7736+0.81X	0.353117232	1.251799436	<0...2
30			T	-26.583+2.2357X	0.327032109	1.147754094	<0.2

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-19

Functional Linear Regression depicting correlation of Soil Moisture with *Hoplolaimus johani* associated with *Carrica papaya* at Allahabad during 1997-98

S.N	H	V	SEX	Y	r	t	p
1	0-10cm	0-10cm	M	37.926-0.885X	-0.686797809	-3.133872579	<0.005
2			F	44.958-0.965X	-0.415736971	-1.516070862	<0.1
3			L	70.859-1.628X	-0.558872109	-2.235225161	<0.025
4			T	153.618-3.474X	-0.552956019	-2.201061764	<0.05
5	10.1-20.0cm		M	41.805-0.947X	-0.55771147	-2.060480497	<0.05
6			F	52.983-1.208X	-0.520728021	-2.022974917	<0.05
7			L	58.683-1.317X	-0.512727794	-1.980692196	<0.05
8			T	153.503-3.473X	-0.550905539	-2.189333686	<0.05
9	20.1-30.0cm		L	46.153-1008X	-0.407713	-1.480906	<0.1
10			T	128.503-2.899X	-0.574683504	-2.329015191	<0.025
11	0-10cm	10.1-20.0cm	M	24.654 -0.34X	-0.186612535	-0.629990431	<0.5
12			L	59.623-1.177X	-0.174629595	-0.588219306	<0.5
13			T	89.368-1.177X	-0.152415768	-0.588219306	<0.5
14	10.1-20.0cm		M	16.618-0.014X	-0.006240117	-0.020696529	<0.5
15			F	22.34-0.075X	-0.029269911	-0.097118925	<0.5
16			L	32.118-0.344X	-0.106339337	-0.354698862	<0.5
17			T	72.984-0.492X	-0.065260718	-0.21690771	<0.5
18	20.1-30.0cm		F	26.534-0.228X	-0.077415897	0.257532367	<0.5
19			L	34.92-0.374X	0.097083195	-0.323516737	<0.5
20			T	86.723-0.832X	-0.092777085	-0.309039701	<0.5
21	0-10cm	20.1-30.0cm	M	-15.265+0.845X	0.387164289	1.392693835	<0.1
22			F	1.012+0.331X	0.2004557	0.678610256	<0.5
23			L	22.89-0.206X	-0.088911885	-0.29605991	<0.5
24			T	8.637+0.97X	0.16861544	0.567357626	<0.5
25	10.1-20.0cm		M	-6.485+0.97X	0.283993816	0.982348021	<0.2
26			F	-12.006+0.76X	0.349597551	1.237514921	<0.2
27			L	5.995+0.329X	0.138650462	0.464336411	<0.5
28			T	-12.528+1.675X	0.261391365	0.898163626	<0.2
29	20.1-30.0cm		M	-3.757+0.491X	0.236000741	0.805478359	<0.4
30			F	12.443+0.798X	0.34848198	1.233078935	<0.2
31			T	-15.076+1.654X	0.270151865	0.930593974	<0.2

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-20

Functional Linear Regression depicting correlation of Soil Moisture with *Hoplolaimus johani* associated with *Carrica papaya* at Allahabad during 1998-99

S.N.	H	V	SEX	Y	r	t	p
01	0-10cm	0-10cm	M	-2.1326+0.949X	0.658109268	2.898972613	<0.05
02			F	-39.568+1.662X	0.681697034	3.090249363	<0.01
03			L	-33.095+1.495X	0.669626009	2.990309435	<0.01
04			T	-93.861+4.102X	0.704701846	3.294178818	<0.005
05	10.1-20.0cm		M	-22.792+1.003X	0.621972185	2.634412188	<0.01
06			F	-32.442+1.443X	0.649220458	2.830949057	<0.01
07			L	-20.138+1.027X	0.517800054	2.007416887	<0.05
08			T	-75.403+3.474X	0.626449573	2.66555434	<0.01
09	20.1-30.0cm		M	-33.830+1.429X	0.533031948	2.089442361	<0.05
10			F	-32.758+1.390X	0.622418923	2.637500305	<0.01
11			L	-36.673+1.584X	0.532225677	2.085031441	<0.05
12			T	-101.837+4.332X	0.557064378	2.224734254	<0.025
13	0-10 cm	10.1-20.0cm	M	-6.409+0.496X	0.311249972	1.086255787	<0.2
14			F	-36.695+0.660X	0.330895636	1.162969836	<0.2
15			L	-5.136+0.568X	0.30765346	1.072383319	<0.2
16			T	-18.74+1.724X	0.33920717	1.195927417	<0.2
17	10.1-20.0cm		M	-7.407+0.516X	0.380798118	1.365871707	<0.1
18			F	-8.162+0.664X	0.374378662	1.339055113	<0.2
19			L	-4.695+0.655X	0.230637571	0.786132636	<0.4
20			T	-20.297+1.836X	0.318672793	1.115051537	<0.2
21	20.1-30.0cm		M	-10.133+0.603X	0.368320002	1.31395.232	<0.2
22			F	-3.805+0.548X	0.253150262	0.86787371	<0.4
23			L	-5.837+0.747X	0.233588981	0.796769285	<0.4
24			T	-14.655+1.744X	0.255986437	0.878274749	<0.2
25	0-10cm	20.1-30.0cm	M	-17.412+0.846X	0.487670216	1.852654514	<0.05
26			F	-14.452+0.734X	0.534024182	2.09488156	<0.05
27			L	-15.987+0.856X	0.40428977	1.466031156	<0.1
28			T	-47.884+2.44X	0.532141367	2.08457066	<0.05
29	10.1-20.0cm		M	-16.349+0.821X	0.505125636	1.941162524	<0.05
30			F	-13.465+0.722X	0.280400748	0.968851462	<0.2
31			L	-18.102+0.957X	0.436315943	1.608253699	<0.1
32			T	-45.076+2.369X	0.525842176	2.050385353	<0.05
33	20.1-30.0cm		M	-14.54+0.732X	0.471240394	1.772017057	<0.1
34			F	-10.592+0.590X	0.517361905	2.005097071	<0.05
35			L	-12.934+0.680X	0.490281297	1.865701922	<0.05
36			T	-40.939+2.134X	0.516625693	2.001203979	<0.05

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-21

Functional Linear Regression depicting correlation of Soil Temperature with *Dolicorhynchus allahabadensis* associated with *Carrica papaya* at Allahabad during 1997-98

S.N.	H	V	SEX	Y	r	t	p
01	0-10cm	0-10cm	M	1.919065+0.4366456X	0.2278954	0.771463392	<0.4
02			F	9.370289+8.651518X	0.4464886	.0.0148085	<0.5
03			L	28.04717-0.6719661X	-0.2380181	-0.8127751	<0.4
04			T	35.4984-0.2266692X	-0.03791924	-0.1258544	<0.5
05	10.1-20.0cm		M	2.82551+0.2575089X	0.135477	0.453434513	<0.5
06			F	16.30588-0.0936397X	-0.3127661	-0.1037836	<0.5
07			L	20.09252-0.3455506X	-0.1291752	-0.4320454	<0.5
08			T	40.68383-0.2071264X	-0.02874397	-0.09537239	<0.5
09	20.1-30.0cm		M	10.789-0.1301795X	-0.8673621	-0.288696027	<0.5
10			F	26.52833-0.6373601X	-0.2571745	-0.882639	<0.2
11			T	58.244-1.147X	-0.1749542	-0.5893473	<0.5
12	0-10 cm	10.1-20.0cm	M	39.37096-1.259546X	-0.4473573	-1.658952441	<0.1
13			L	45.35807-1.442745X	-0.4865047	-1.846852	<0.05
14			T	152.5-4.968197X	-0.5291623	-2.068344	<0.05
15	10.1-20.0cm		M	58.80807-1.945925X	-0.5459128	-2.143759108	<0.05
16			F	51.83869-1.558531X	-0.484004	-1.834444	<0.05
17			L	47.63478-1.48628X	-0.317655	-1.11109	<0.2
18			T	185.2815-4.990737X	-0.5207301	-2.022986	<0.05
19	20.1-30.0cm		M	26.65561-0.8228526X	-0.3991612	-1.44385762	<0.1
20			F	49.83549-1.667936X	-0.5045545	-1.938217	<0.05
21			L	60.82426-1.971347X	-0.3991612	-1.44385762	<0.1
22			T	137.3154-4.430135X	-0.4914184	-1.871405	<0.05
23	0-10cm	20.1-30.0cm	M	18.37978-0.4640633X	-0.2079475	-0.704978839	<0.4
24			F	30.51862-0.9146053X	-0.3887441	-1.399386	<0.1
25			T	70.29523-1.933783X	-0.2904941	-1.00688	<0.2
26	10.1-20.0cm		M	26.95661-0.8599002X	-0.4323121	-1.58992612	<0.1
27			F	35.71343-1.09646X	-0.4007992	-1.450939	<0.1
28			L	36.36636-0.9673256X	-0.252292	-0.8647308	<0.4
29			T	99.03639-2.923686X	-0.3637153	-1.295002	<0.2
30	20.1-30.0cm		M	17.29967-0.436006X	-0.2126058	-0.721614321	<0.4
31			F	26.88682-0.6763095X	-0.2080785	-0.7055615	<0.4
32			L	42.33652-1.31007X	-0.3792847	-1.359529	<0.2
33			T	86.495-2.422X	-0.29794518	-1.035187499	<0.2

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-22

Functional Linear Regression depicting correlation of Soil Temperature with *Dolicorhynchus allahabadensis* associated with *Carrica papaya* at Allahabad during 1998-99

S.N.	H	V	SEX	Y	r	t	p
01	0-10cm	0-10cm	M	-11.082+0.9325X	0.198666905	0.672304584	<0.5
02			F	-3.5332+0.7159X	0.134665755	0.450741552	<0.5
03			L	12.688-0.047X	-0.010442854	-0.034636918	<0.5
04			T	-1.927+1.601X	0.11951452	0.39924644	<0.5
05	10.1-20.0cm		M	-10.1668+0.793X	0.250203029	0.857090721	<0.4
06			F	-1.972+0.624X	0.133663041	0.44732407	<0.5
07			L	2.9727+0.26198X	0.091378337	0.304340945	<0.5
08			T	-9.1665+1.679X	0.155594737	0.522411831	<0.5
09	20.1-30.0cm		M	-22.1194+1.33X	0.34761792	1.229600696	<0.2
10			F	6.1474+0.29X	0.050847996	0.168862165	<0.5
11			L	-17.043+1.0915X	0.364353298	0.062764755	<0.5
12			T	-33.015+2.712X	0.229934842	0.783603445	<0.4
13	0-10cm	10.1-20.0cm	M	-1.296+0.35X	0.157435808	0.528749423	<0.5
14			F	-1.5791+0.774X	0.167835311	0.564656378	<0.5
15			T	-10.7125+1.91X	0.217593484	0.739392163	<0.4
16	10.1-20.0cm		M	1.298+0.3917X	0.135790199	0.454575596	<0.5
17			L	-4.2294+0.62589X	0.224687788	0.764759368	<0.4
18			T	-30.5169+2.849X	0.327251268	1.148615475	<0.2
19	20.1-30.0cm		M	-12.6217+0.822X	0.498157269	1.905462006	<0.05
20			F	-3.51858+0.4655X	0.29469198	1.022803064	<0.2
21			L	2.1913+0.291X	0.144005006	0.482641162	<0.5
22			T	-13.953+1.579X	0.338892778	1.194675085	<0.2
23	0-10cm	20.1-30.0cm	M	-16.438+0.949X	0.533943792	2.09444043	<0.05
24			F	-4.925+0.623655	0.196720996	0.665453013	<0.5
25			L	-11.9154+0.846X	0.373405818	1.335010872	<0.2
26			T	-33.27826+2.42X	0.367370986	1.310036707	<0.2
27	10.1-20.0cm		M	3.8237+0.11895X	0.052823636	0.175441123	<0.5
28			F	-13.017+1.0745X	0.31134379	1.08661835	<0.2
29			L	-31.7754+1.6948X	0.607394033	2.535871485	<0.025
30			T	-32.4659+2.5087X	0.337791322	1.190291166	<0.2
31	20.1-30.0cm		M	-10.9217+0.752X	0.366480542	1.306368076	<0.2
32			F	-2.9381+0.61X	0.183478407	0.619037984	<0.5
33			L	-19.2158+1.12666X	0.532927447	2.088870217	<0.05
34			T	-33.0755+2.489X	0.360059928	1.280036808	<0.2

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-23

Functional Linear Regression depicting correlation of Moisture with *Dolicorhynchus allahabadensis* associated with *Carrica papaya* at Allahabad during 1997-98

S.N.	H	V	SEX	Y	r	t	p
01	0-10cm	0-10cm	L	37.7196-0.82884235X	-0.474869701	-1.789618408	<0.10
02	10.1-20.0cm		F	52.73161-1.223747X	-0.661476089	-2.925288952	<0.05
03			L	44.90028-0.52668X	-0.636825617	-2.739416443	<0.01
04	20.1-30.0cm		M	27.21237-0.6201906X	-0.668705617	-2.98287061	<0.01
05			F	33.22996-0.7076343X	-0.462024537	-1.727837195	<0.10
06			L	40.03915-0.899X	-0.504750396	-1.939227269	<0.05
07			T	100.4815-2.226903X	-0.552538193	-2.198667283	<0.05
08	0-10cm	10.1-20.0cm	M	16.67524-0.2168159X	-0.142241877	-0.476079133	<0.5
09			F	12.94683+0.04289267X	0.017196038	0.057041241	<0.5
10			L	20.83996-0.2940951X	-0.183178368	-0.617990504	<0.5
11	10.1-20.0cm		F	30.95647-0.4910483X	-0.28168253	-0.973661079	<0.2
12			L	17.58382-0.1546941X	-0.061063656	-0.202903882	<0.5
13	20.1-30.0cm		M	14.63738-0.2285345X	-0.204762554	-0.693821478	<0.5
14			F	14.17102-0.113566X	-0.063456072	-0.210884995	<0.5
15			L	31.19954-0.5217697X	-0.222514487	-0.756974894	<0.4
16	0-10cm	20.1-30.0cm	M	9.234742-0.05934X	-0.002595208	-0.00860736	<0.5
17			F	4.308742+0.1277905X	0.10804534	0.360455974	<0.5
18			L	1.852306+0.1862788X	0.126363234	0.422486066	<0.5
19			T	15.39579+0.2547347X	0.076122688	0.253205079	<0.5
20	10.1-20.0cm		M	11.7497-0.1619243X	-0.161948672	-0.544308294	<0.5
21			F	-1.859569-10.3371072X	0.245019187	0.838186106	<0.4
22			L	10.55599+0.07804715X	0.040491307	0.134404699	<0.5
23	20.1-30.0cm		F	-3.896506+0.435X	0.266466387	0.916921028	<0.2
24			T	1.23732+0.8125365X	0.198785867	0.672723717	<0.5

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Table No.-24

Functional Linear Regression depicting correlation of Moisture with *Dolicorhynchus allahabadensis* associated with *Carrica papaya* at Allahabad during 1998-99

S.N.	H	V	SEX	Y	r	t	p
01	0-10cm	0-10cm	M	-33.603+1.393X	0.69215256	3.180611619	<0.005
02			F	-34.313+1.494X	0.655284415	2.877129496	<0.01
03			L	-17.591+0.918X	0.472916934	1.780133401	<0.1
04			T	-85.538+3.806X	0.662381816	2.932421801	<0.01
05	10.1-20.0cm		M	-17.239+0.729X	0.563042752	2.259606486	<0.025
06			F	-24.812+1.25X	0.465728557	1.745506441	<0.1
07			L	5.763+0.15X	0.087015978	0.289698199	<0.5
08			T	-36.289+2.129X	0.417005767	1.521669954	<0.1
09	20.1-30.0cm		M	-11.739+0.574X	0.534632944	2.09822464	<0.05
10			F	-15.226+0.789X	0.411906763	1.499233106	<0.1
11			L	-17.636+0.817X	0.596505068	2.484939633	<0.025
12			T	-45.835+2.218X	0.557284888	2.226011488	<0.025
13	0-10cm	10.1-20.0cm	M	-18.743+0.852X	0.627121907	2.670267896	<0.01
14			F	-23.455+1.134X	0.566237781	2.278455115	<0.25
15			L	-19.264+0.892X	0.64230823	2.779444592	<0.01
16			T	-61.494+2.879X	0.621967476	2.634379656	<0.01
17	10.1-20.0cm		M	-3.596+0.439X	0.261785803	0.899618584	<0.2
18			F	-1.29+0.525X	0.255852027	0.877781286	<0.2
19			L	-7.771+0.552X	0.341031616	1.203203781	<0.2
20			T	-48.869+2.58X	0.509463646	1.963343363	<0.05
21	20.1-30.0cm		M	-7.875+0.45X	0.330757728	1.16242559	<0.2
22			F	-22.204+1.096X	0.525560559	2.048868048	<0.05
23			L	-15.596+0.785X	0.465796558	1.74583191	<0.1
24			T	-44.297+2.263X	0.503512197	1.932851855	<0.05
25	0-10cm	20.1-30.0cm	M	-20.003+0.91X	0.554661335	2.210859455	<0.025
26			F	-40.506+1.681X	0.686537953	3.131929328	<0.005
27			L	-19.105+0.866X	0.673899114	3.02517967	<0.01
28			T	-75.227+3.319X	0.655856407	2.881535188	<0.01
29	10.1-20.0cm		M	6.899-0.002X	0.003061745	-0.010154706	<0.5
30			F	-8.061+0.468X	0.510092929	1.966921172	<0.05
31			L	-10.069+0.576X	0.490039432	1.864490573	<0.05
32			T	-8.869+0.971X	0.358530274	1.273794687	<0.2
33	20.1-30.0cm		M	-12.502+0.618X	0.498641783	1.9077928181	<0.050
34			F	-14.859+0.829X	0.412348225	1.501168876	<0.1
35			L	-10.87+0.596X	0.467107854	1.752115904	<0.1
36			T	-38.264+2.044X	0.489322542	1.860903448	<0.05

Where: **H = Horizontal Distance in "cm" From the Plant Stem**
V = Vertical Depth in "cm" in Soil
M = Male
F = Female
L = Larva
T = Total

Note: Only Significant Level Shown in the Table.

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 0-10 cm, V = 0-10 cm, during 1997-98

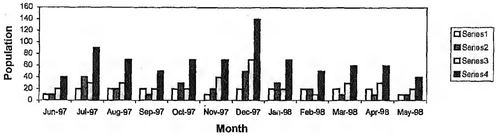


Figure No. 1

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 10.1-20.0 cm, V = 0-10 cm, during 1997-98

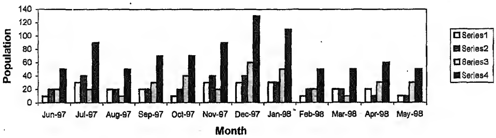


Figure No. 2

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 20.1-30.0 cm, V = 0-10 cm, during 1997-98

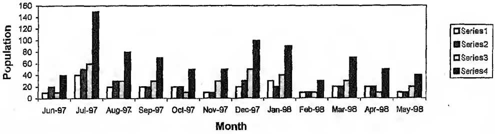


Figure No. 3

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 0-10 cm, V = 10.1-20.0 cm, during 1997-98

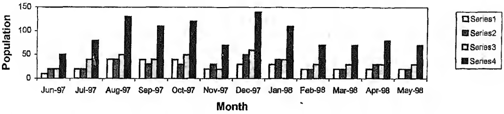


Figure No. 4

Month-Population Hostogram of *Hoplolaimus johani* around *Psidium guajava*, H = 10.1-20.0 cm, V = 10.1-20.0 cm, during 1997-98

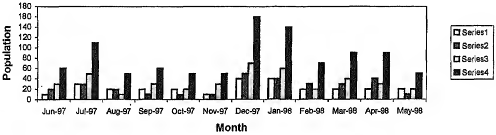


Figure No. 5

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 20.1-30.0 cm, V = 10.1-20.0 cm, during 1997-98

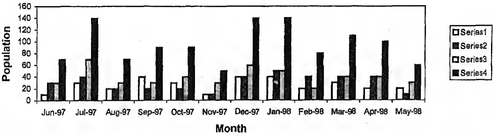


Figure No. 6

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 0-10 cm, V = 20.1-30 cm, during 1997-98

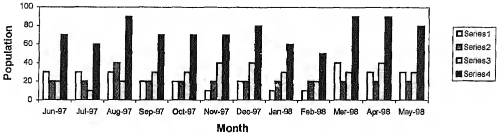


Figure No. 7

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 10.1-20.0 cm, V = 20.1-30.0 cm, during 1997-98

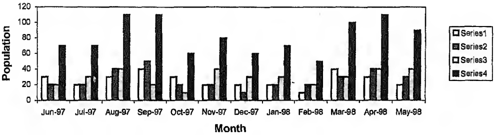


Figure No. 8

Month-Population Histogram of *Hoplolaimus johani* aroun *Psidium guajava*, H = 20.1-30.0 cm, V = 20.1-30.0 cm, during 1997-98

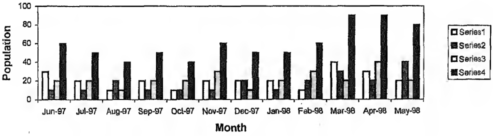


Figure No. 9

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 0-10 cm, V = 0-10 cm during 1998-99

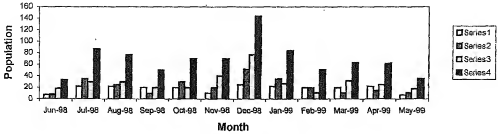


Figure No. 10

Mon'h-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 10.1-20.0 cm, V = 0-10 cm, durimg 1998-99

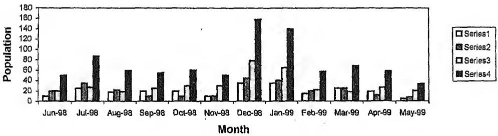


Figure No. 11

Month-Population Histogram of Hoplolaimus johani around Psidium guajava, H = 20.1-30.0 cm, V = 0-10 cm, during 1998-99

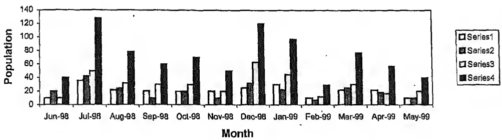


Figure No. 12

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 0-10 cm, V = 10.1-20.0 cm, during 1998-99

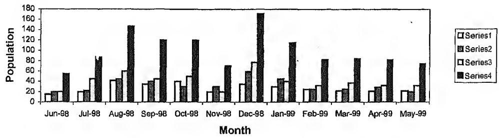


Figure No. 13

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 10.1-20.0 cm, V = 10.1-20.0 cm, during 1998-99

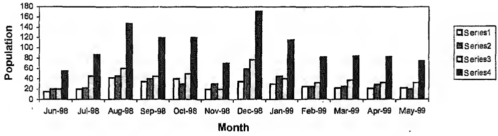


Figure No. 14

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 20.1-30.0 cm, V = 10.1-20.0 cm, during 1998-99

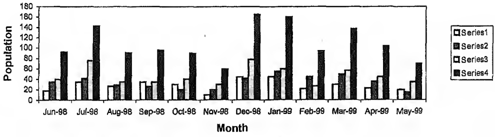


Figure No. 15

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 0-10 cm, V = 20.1-30.0 cm, during 1998-99

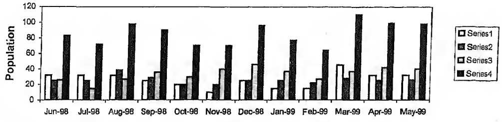


Figure No. 16

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 10.1-20.0 cm, V = 20.1-30.0 cm, during 1998-99

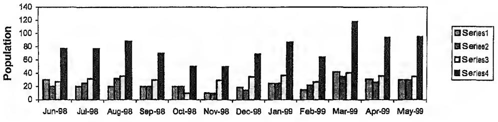


Figure No.17

Month-Population Histogram of *Hoplolaimus johani* around *Psidium guajava*, H = 20.1-30 cm, V = 20.1-30.0 cm, during 1998-99

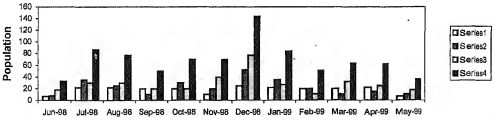


Figure No. 18

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 0-10 cm, V = 0-10 cm, during 1997-98

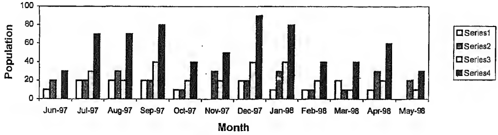


Figure No. 19

Month-Population Histogram of *Dolicorhynchus allhabadensis* around *Psidium guàjava*, H = 10.1-20.0 cm, V = 0-10 cm, during 1997-98

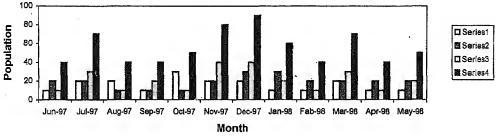


Figure No. 20

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 20.1-30.0 cm, V = 0-10 cm, during 1997-98

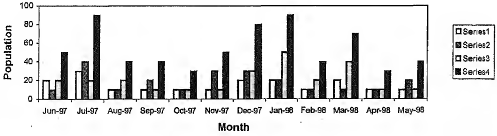
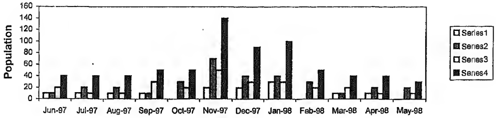


Figure No. 21

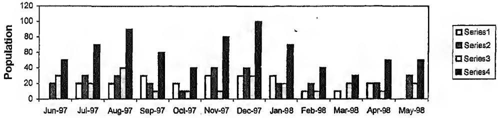
Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 0-10 cm, V = 10.1-20.0 cm, during 1997-98



Month

Figure No. 22

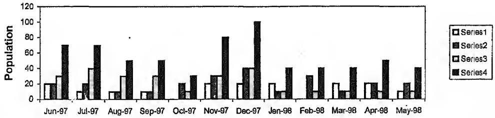
Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 10.1-20.0 cm, V = 10.1-20.0 cm, during 1997-98



Month

Figure No. 23

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 20.1-30.0 cm, V = 10.1-20.0 cm, during 1997-98



Month

Figure No. 24

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 0-10 cm, V = 20.1-30.0 cm, during 1997-98

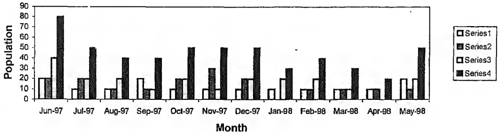


Figure No. 25

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 10.1-20.0 cm, V = 20.1-30.0 cm, during 1997-98

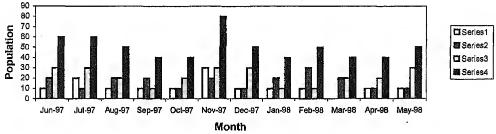


Figure No. 26

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 20.1-30.0 cm, V = 20.1-30.0 cm, during 1997-98

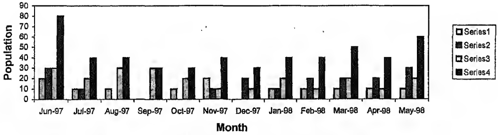


Figure No. 27

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 0-10 cm, V = 0-10 cm, during 1998-99

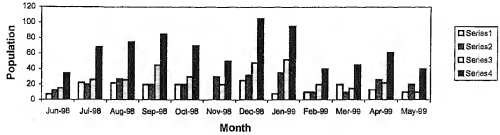


Figure No. 28

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 10.1-20.0 cm, V = 0-10 cm, during 1998-99

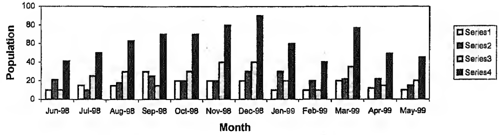


Figure No. 29

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H = 20.1-30.0 cm, V = 0-10 cm, during 1998-99

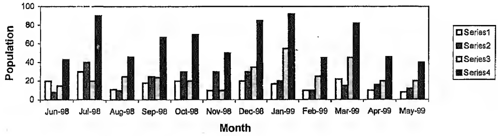


Figure No. 30

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H =0-10 cm, V = 10.1-20.0 cm, during 1998-99

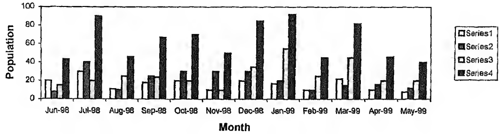


Figure No.31

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H =10.1-20.0 cm, V = 10.1-20.0 cm, during 1998-99

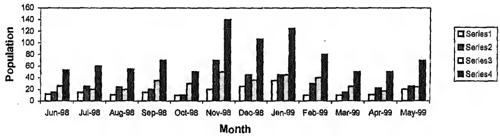


Figure No. 32

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H =20.1-30.0 cm, V = 10.1-20.0 cm, during 1998-99

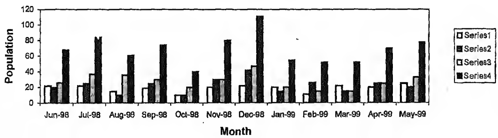


Figure No. 33

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H =0-10 cm, V = 20.1-30.0 cm, during 1998-99

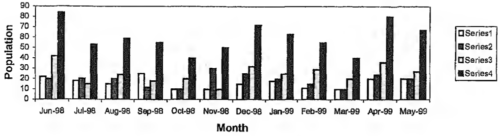


Figure No. 34

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H =10.1-20.0 cm, V = 20.1-30.0 cm, during 1998-99

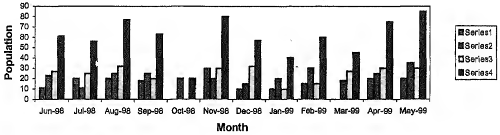


Figure No. 35

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H =20.1-30.0 cm, V = 20.1-30.0 cm, during 1998-99

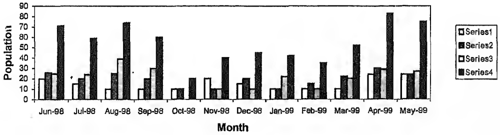
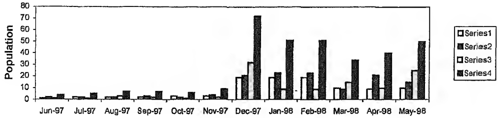


Figure No. 36

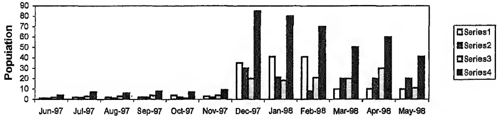
Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H =0-10 cm, V = 0-10 cm, during 1997-98



Month

Figure No. 37

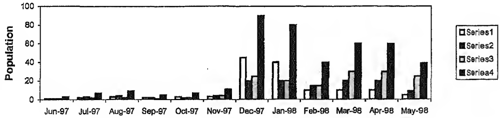
Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H =10.1-20.0 cm, V = 0-10 cm, during 1997-98



Month

Figure No. 38

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H =20.1-30.0 cm, V = 0-10 cm, during 1997-98



Month

Figure No. 39

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 0-10 cm, V = 10.1-20.0 cm, during 1997-98

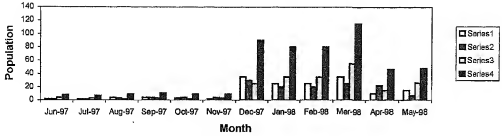


Figure No. 40

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 10.1-20.0 cm, V = 10.1-20.0 cm, during 1997-98

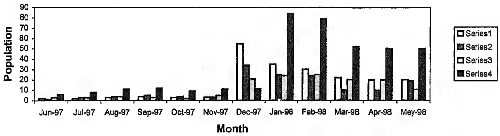


Figure No. 41

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 20.1-30.0 cm, V = 10.1-20.0 cm, during 1997-98

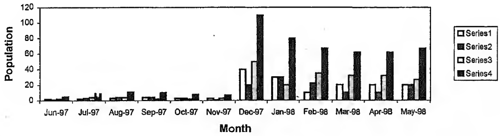


Figure No. 42

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 0-10 cm, V = 20.1-30.0 cm, during 1997-98

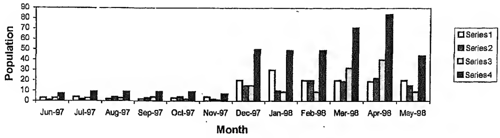


Figure No. 43

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 10.1-20.0 cm, V = 20.1-30.0 cm, during 1997-98

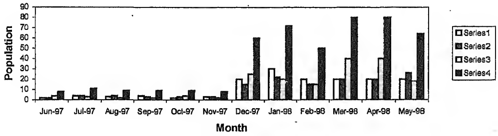


Figure No. 44

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 20.1-30.0 cm, V = 20.1-30.0 cm, during 1997-98

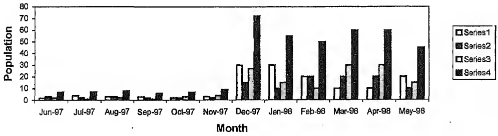
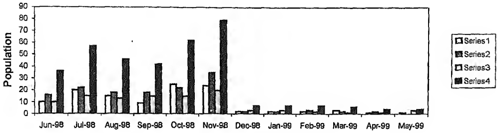


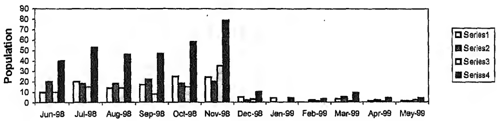
Figure No. 45

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 0-10 cm, V = 0-10 cm, during 1998-99



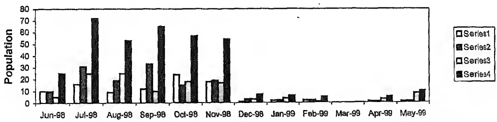
MonthFigure No. 46

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 10.1-20.0 cm, V = 0-10 cm, during 1998-99



Month
Figure No. 47

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 20.1-30.0 cm, V = 0-10 cm, during 1998-99



Month
Figure No. 48

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 0-10 cm, V = 10.1-20.0 cm, during 1998-99

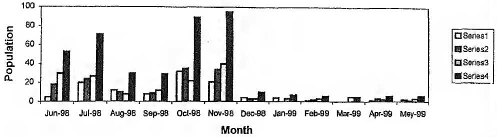


Figure No. 49

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 10.1-20 cm, V = 10.1-20.0 cm, during 1998-99

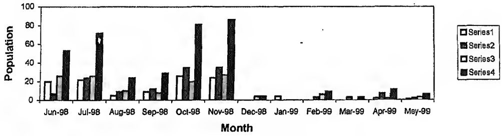
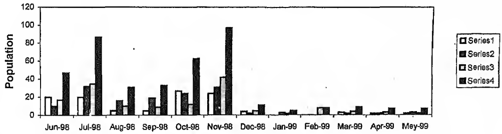


Figure No. 50

Month-Population Histogram of Hoplolaimus johani around Zyzyphus jujuba, H = 20.1-30 cm, V = 10.1-20.0 cm, during 1998-99



MonthFigure No. 51

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 0-10 cm, V = 20.1-30.0 cm, during 1998-99

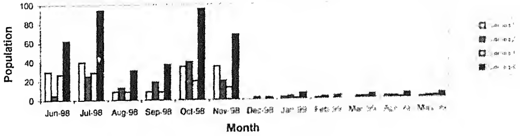


Figure No. 52

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 10.1-20.0 cm, V = 20.1-30.0 cm, during 1998-99

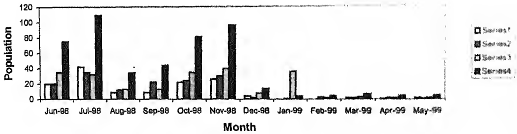


Figure No. 53

Month-Population Histogram of *Hoplolaimus johani* around *Zyzyphus jujuba*, H = 20.1-30.0 cm, V = 20.1-30.0 cm, during 1998-99

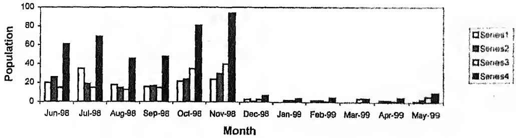


Figure No. 54

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Zyzyphus jujuba*, , H =0-10.0 cm, V = 0-10.0 cm, during 1997-98

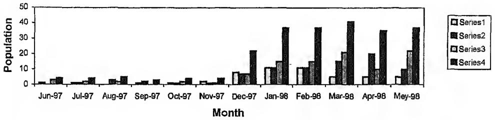


Figure No. 55

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Zyzyphus jujuba*, H =10.1-20.0 cm,V = 0-10.0 cm, during 1997-98

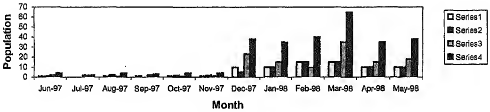


Figure No. 56

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Zyzyphus jujuba*, H =20.1-30.0 cm, V = 0-10.0 cm, during 1997-98

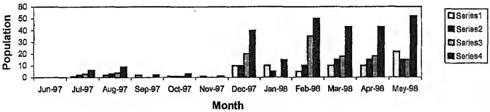
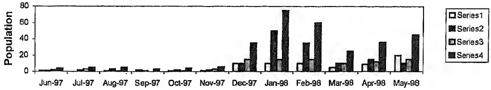


Figure No. 57

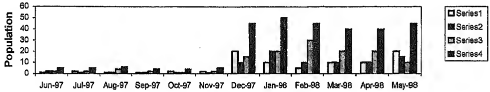
Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Zyzyphus jujuba*, H =0-10.0 cm,V = 10.1-20.0 cm, during 1997-98



Month

Figure No. 58

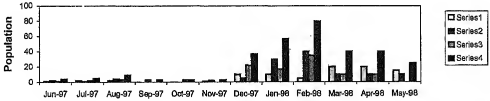
Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Zyzyphus jujuba*, H =10.1-20.0 cm, V = 10.1-20.0 cm, during 1997-98



Month

Figure No. 59

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Zyzyphus jujuba*, H =20.1-30.0 cm, V = 10.1-20.0 cm, during 1997-98



Month

Figure No. 60

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Zyzyphus jujuba*, H =0-10.0 cm, V = 20.1-30.0 cm, during 1997-98

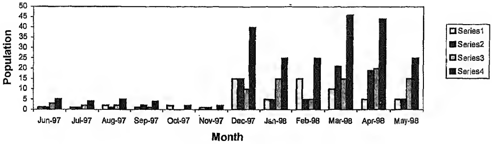


Figure No. 61

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Zyzyphus jujuba*, H =10.1-20.0 cm, V = 20.1-30.0 cm, during 1997-98

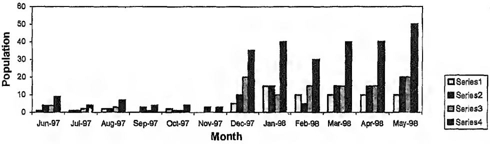


Figure No. 62

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Zyzyphus jujuba*, H =20.1-30.0 cm,V = 20.1-30.0 cm, during 1997-98

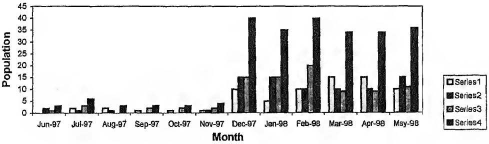


Figure No. 63

Month-Population Histogram of Dolicorhynchus allahabadensis around *Zyzyphus jujuba*, H =0-10.0 cm, V = 0-10.0 cm, during 1998-99

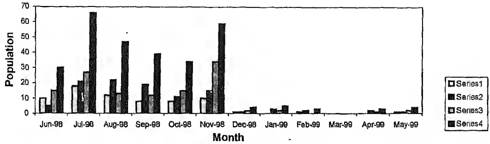


Figure No. 64

Month-Population Histogram of Dolicorhynchus allahabadensis around *Zyzyphus jujuba*, H =10.1-20.0 cm, V = 0-10.0 cm, during 1998-99

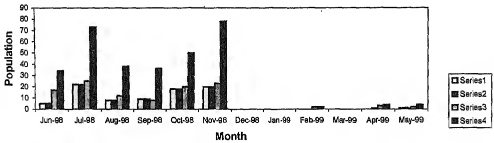


Figure No. 65

Month-Population Histogram of Dolicorhynchus allahabadensis around Psidium guajava, H =20.1-30.0 cm, V = 0-10.0 cm, during 1998-99

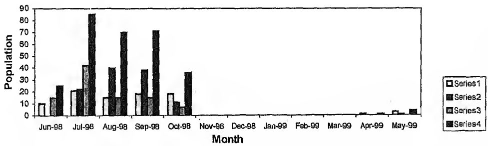


Figure No. 66

Month-Population Histogram of Dolicorhynchus allahabadensis around *Zyzyphus jujuba*, H =0-10.0 cm, V = 10.1-20.0 cm, during 1998-99

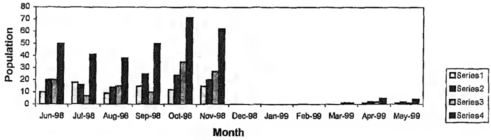


Figure No. 67

Month-Population Histogram of Dolicorhynchus allahabadensis around *Zyzyphus jujuba*, H =10.1-20.0 cm, V = 10.1-20.0 cm, during 1998-99

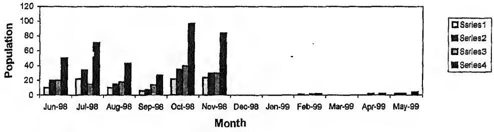


Figure No. 68

Month-Population Histogram of Dolicorhynchus allahabadensis around *Zyzyphus jujuba* H =20.1-30.0 cm, V = 10.1-20.0 cm, during 1998-99

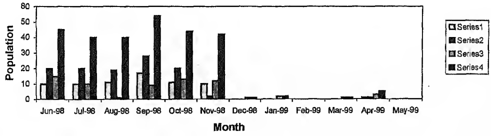


Figure No. 69

Month-Population Histogram of Dolicorhynchus allahabadensis around *Zyzyphus jujuba*, H =0-10.0 cm, V = 20.1-30.0 cm, during 1998-99

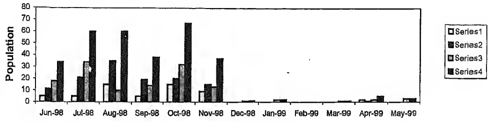


Figure No. 70

Month-Population Histogram of Dolicorhynchus allahabadensis around *Zyzyphus jujuba* H =10.1-20.0 cm, V = 20.1-30.0 cm, during 1998-99

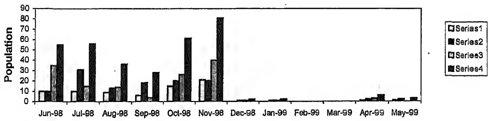


Figure No. 71

Month-Population Histogram of Dolicorhynchus allahabadensis around *Zyzyphus jujuba*, H =20.1-30.0 cm,V = 20.1-30.0 cm, during 1998-99

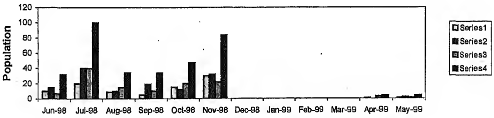


Figure No. 72

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =0-10.0 cm, V = 0-10.0 cm, during 1997-98

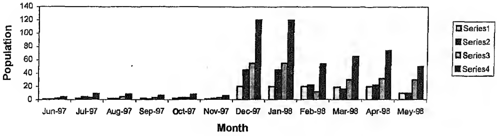


Figure No. 73

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =10.1-20.0 cm, V = 0-10.0 cm, during 1997-98

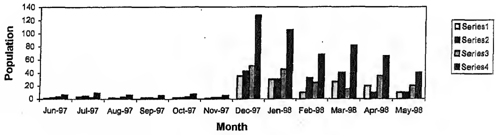


Figure No. 74

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =20.1-30.0 cm,V = 0-10.0 cm, during 1997-98

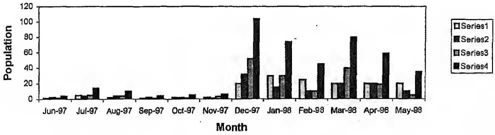


Figure No. 75

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =0-10.0 cm, V = 10.1-20.0 cm, during 1997-98

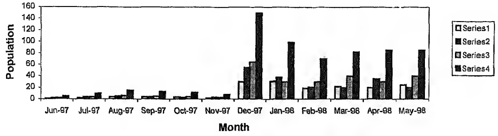


Figure No. 76

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =10.1-20.0 cm, V = 10.1-20.0 cm, during 1997-98

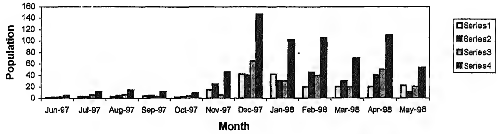


Figure No. 77

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =20.1-30.0 cm,V =10.1-20.0 cm, during 1997-98

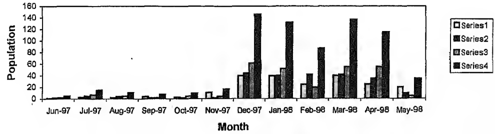


Figure No.78

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =0-10.0 cm, V = 20.1-30.0 cm, during 1997-98

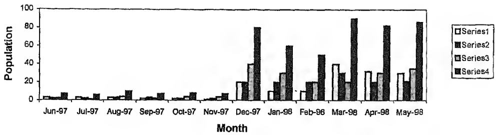


Figure No. 79

Month-Population Histogram of *Hoplolaimus johani* around Carica papaya,H =10.1-20.0 cm, V = 20.1-30.0 cm, during 1997-98

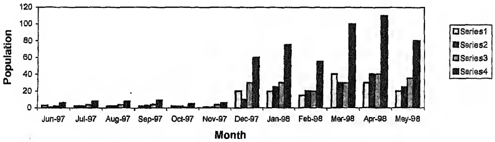


Figure No.80

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =20.1-30.0 cm,V = 20.1-30.0 cm, during 1997-98

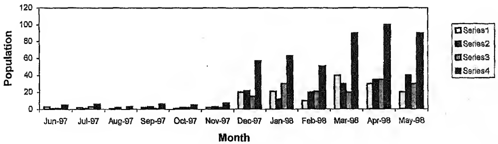


Figure No.81

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =0-10.0 cm, V = 0-10.0 cm, during 1998-99

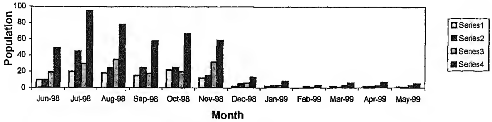


Figure No. 82

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =10.1-20.0 cm, V = 0-10.0 cm, during 1998-99

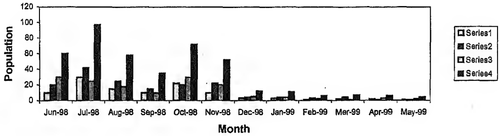


Figure No.83

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =20.1-30.0 cm, V = 0-10.0 cm, during 1998-99

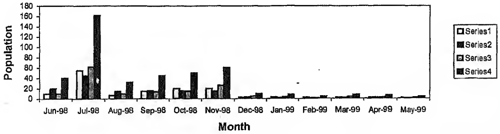


Figure No. 84

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =0-10.0 cm, V = 10.1-20.0 cm, during 1998-99

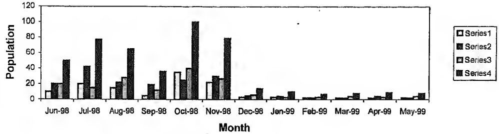


Figure No.85

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =10.1-20.0 cm, V = 10.1-20.0 cm, during 1998-99

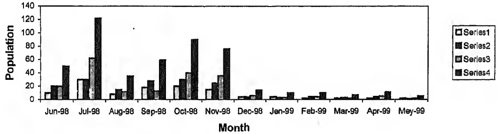


Figure No. 86

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =20.1-30.0 cm, V = 10.1-20.0 cm, during 1998-99

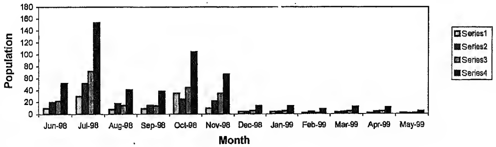


Figure No. 87

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =0-10.0 cm, V = 20.1-30.0 cm, during 1998-99

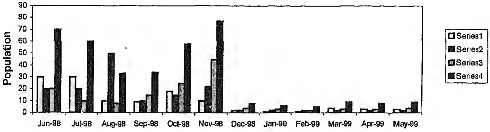


Figure No. 88

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =10.1-20.0 cm, V = 20.1-30.0 cm, during 1998-99

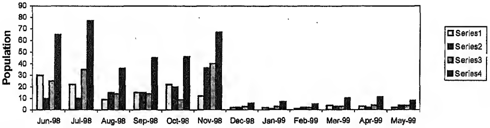


Figure No. 89

Month-Population Histogram of *Hoplolaimus johani* around *Carica papaya*, H =20.1-30.0 cm,V = 20.1-30.0 cm, during 1998-99

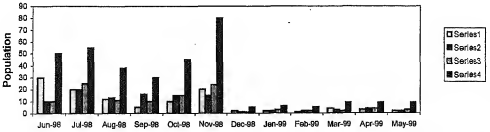


Figure No.90

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =0-10.0 cm, V = 0-10.0 cm, during 1997-98,

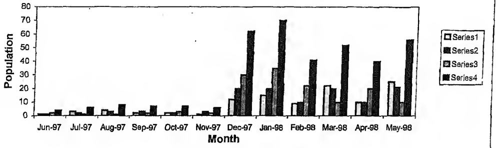


Figure NO.91

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =10.1-20.0 cm, V = 0-10.0 cm, during 1997-98,

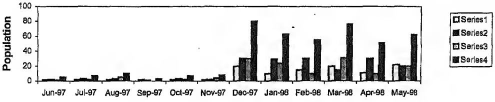


Figure No.92

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =20.1-30.0 cm, V = 0-10.0 cm, during 1997-98,

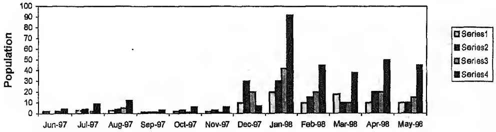


Figure No. 93

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya,* H =0-10.0 cm, V = 10.1-20.0 cm, during 1997-98,

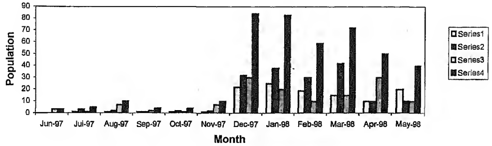


Figure No. 94

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya,* H =10.1-20.0 cm, V = 10.1-20.0 cm, during 1997-98,

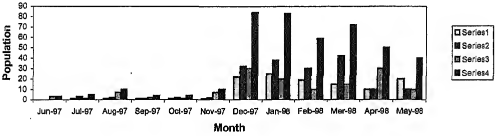


Figure No. 95

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya,* H =20.1-30.0 cm,V = 10.1-20.0 cm, during 1997-98,

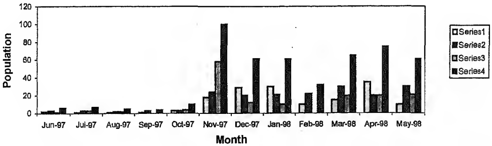


Figure No. 96

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =0-10.0 cm, V = 20.1-30.0 cm, during 1997-98,

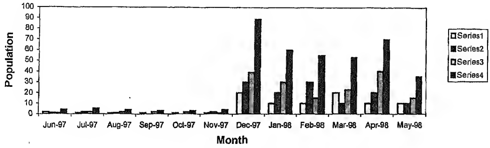


Figure No. 97

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =10.1-20.0 cm, V = 20.1-30.0 cm, during1997-98,

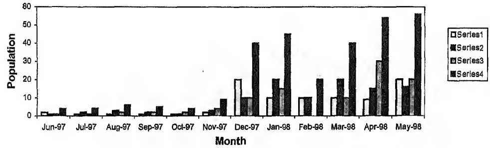


Figure No.98

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =20.1-30.0 cm,V = 20.1-30.0 cm, during 1997-98,

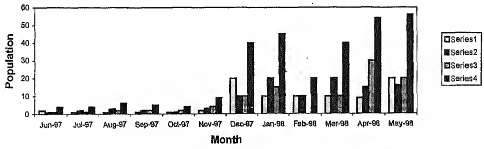


Figure No. 99

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =0-10.0 cm, V = 0-10.0 cm, during 1998-99

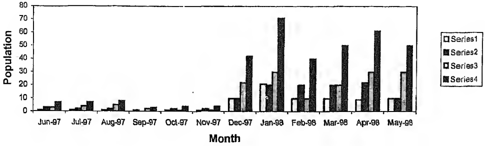


Figure No. 100

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =10.1-20.0 cm, V = 0-10.0 cm, during 1998-99

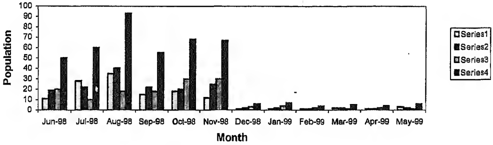
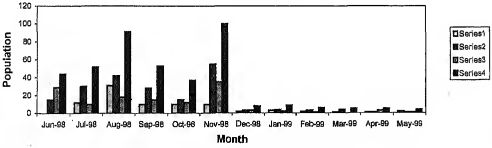


Figure No. 101

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =20.1-30.0 cm,V = 0-10.0 cm, during 1998-99



Fogure No. 102

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =0-10.0 cm, V = 10.1-20.0 cm, during 1998-99

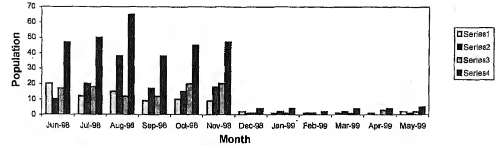


Figure No. 103

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =10.1-20.0 cm, V = 10.1-20.0 cm, during 1998-99

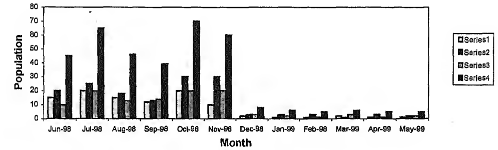


Figure No. 104

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Psidium guajava*, H =20.1-30.0 cm,V = 10.1-20.0 cm, during 1998-99

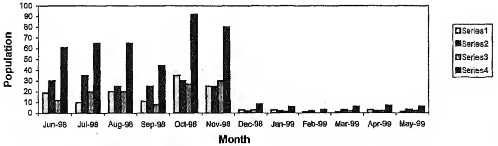


Figure No. 105

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =0-10.0 cm, V = 20.1-30.0 cm, during 1998-99

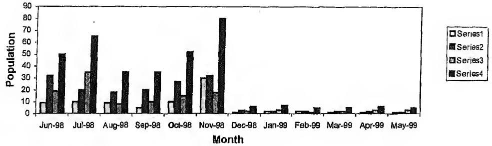


Figure No. 106

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =10.1-20.0 cm, V = 20.1-30.0 cm, during 1998-99

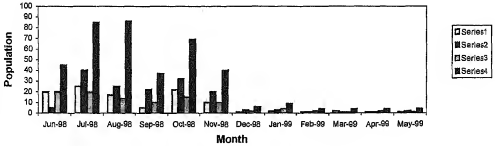


Figure No. 107

Month-Population Histogram of *Dolicorhynchus allahabadensis* around *Carica papaya*, H =20.1-30.0 cm,V = 20.1-30.0 cm, during 1998-99

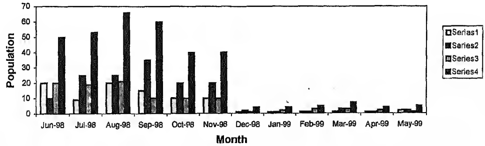


Figure No. 108

Details of graphical representation:

Where

H	= Horizontal Distance,
V	= Vertical Depth,
Series 1	= Male Population,
Series 2	= Female Population
Series 3	= Larva Population and
Series 4	= Total Population of Nematodes

APPENDIX

LIST OF PUBLICATIONS

1. *Dolichorhynchus allahabadensis* n. sp. infesting rhizosphere of a sub- humid region

2. Bioecology of nematodes in soil of a sub-humid region:

   I. *Hoplolaimus johani* sp. nov. and

   II. *H. caudifurcatus* sp. nov.

   around fruit crops.

3. Bioecology of *Paratylenchus guajavai* sp. nov. of sub humid- region around fruit plants

NOTE:

A few selected photomicrographs related with above three publications present in plate section of this thesis.

DOLICHORHYNCHUS ALLAHABADENSIS N.SP. INFESTING RHIZOSPHERE OF A SUB- HUMID REGION

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Parasitology Laboratory, Department of Zoology,
University of Allahabad, Allahabad, U.P., India

INTRODUCTION

Siddiqi (1986) presented a summary diagnosis of genus Dolichorhynchus Mulkand jairajpuri (1974), and raised new subgenera Dolichorhynchus Mulk and jairajpuri (1974) (n. rank) and Neodolichorynchus jairajpuri and Hunt (1984) (n. rank) under the genus. Earlier, Sher (1973) provided a revised key to genera of subfamily Tylenchorhynchinae. But the 2 species, Tyenchorhynchus phaseoli Sethi ands Swaroop (1968) and T lamelliferus (de Man) were synonymized by Siddiqi (1986) with D.(D) phaseoli (Sethi and Swaroop) Mulk and jairajpuri and D.(D.) lamelliferus Mulk and Siddiqi, respectively.

DOLICHORHYNCHUS ALLAHABADENSIS N.SP.

(Figs. 1-12)

Measurements:
5 females: L = 0.50 - 0.60, spear = 16 - 20μ; a = 36 - 40; b = 5 - 6.5; c = 10 - 13; v = 50 - 60; labial annules = 4; labial region offset. (Figs.1-3)
3 Males: L=0.548-0.651; a=25-28; b=5-6; c=10-15; spear 16-17μ; Spicule length = 0.02 - 0.022; gubernaculum = 10μ; Bursa length = 0.07 - 0.19; tail annules = 25 - 30. (Figs.4-7).
Female (Holotype) : L = 0.55; spear = 17; a = 8; b = 5.5; c = 13; v = 58; labial annules = 4; head region offset.

Small sized worms normally less than 1 mm, cylindrical with broadly conical tail with bluntly rounded tail tip. Body becoming slightly ventrally curved on death. Body prominently annulated with transverse prominent striations. Longitudinal ridges running the whole length of body not observed. Lateral field with 3 incisors, aerolated. Head region (Fig.1) rounded moderately sclerotized and offset from the body. Labial disc distinct. Spear 17μ long (Fig.8). Cones solid, 10μ long. Basal knob rounded not anteriorly accurate. Median bulb rounds to oval in shape with labial valve plates not set off from the precarpus. Basal bulb offset from the intestine. Cardia not distinct. Vulva (Fig.2, 10) slightly above 50% of the body length. Tail 75μ long, broadly truncated (Fig.3, 9).

Allotype Male: L = 0.651; a = 27.94; b = 14.76; b = 23.17; C = 12.57 O = 83.33; R = 482; Ran = 29; Cp. = 0.0169; Bursa L = 0.081; median bulb of Oesophagus = 0.007 (dia.); basal bulb (dia.) = 0.009; head = 0.651 x 0.021; Spicules: Left = 0.022, right = 0.02.

Body contour similar to female; slightly curved ventrally after death. Head offset from rest of the body; slightly ventrally curved; tail with bursa notched as in Dolichorhynchus; gubernaculum = 10μ

Type specimen: Collected by the authors in February 2000.

Holotype: Slide No. PNLS 106/2000 deposited with the Parasitology Laboratory Department of Zoology, University of Allahabad, Allahabad.

Para Type: Slide No. PNLS 107/2000 deposited with the Parasitology Laboratory, Department of Zoology, University of Allahabad, Allahabad. U.P. India.

Type Habitat: Rhizosphere of guava (Psidium guajava). Similar specimens were also found in the rhizosphere of rose (Rosa alba) in the Botanical Garden of the Department of Botany. University of Allahabad, Allahabad.

Type locality: Botanical garden Department of Botany, University of Allahabad, Allahabad, U.P., India.

Diagnosis: Dolichorhynchus allahabadensis n.sp. comes closer to D. phaseoli Sethi and Swaroop (1968). However it differs from D. phaseoli having a relatively shorter body length, stylet, lower c value, higher V percentage, lesser labial annules. The body does not show prominent longitudinal ridges running the whole length of body as found in D. phaseoli the male of D. allahabadensis n.sp. differs from D. phaseoli in having relatively shorter body length, lower values of a, b and spear, Spicule length and higher tail annules.

Acknowledgements:
The authors are grateful to Prof. H.R. Singh Head, Department of Zoology University of Allahabad for laboratory and library facilities.

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Explanation of Figures:

Figs.1-12. Dolichorhynchus allahabadensis n.sp.

1. Photomicrograph of anterior end of female (x950)
2. Photomicrograph of a part of body of female to show vulva (x980).
3. Photomicrograph of posterior end of female (x950);
4. Photomicrograph of anterior end of male (x950);
5. Photomicrograph of whole male worm (x180);
6. Photomicrograph of posterior end of male to show forked tail (x950).
7. Photomicrograph of lateral view of the posterior end of male to show Spicules and conical tail (x950);
8. Anterior end of female (x400);
9. Posterior end of female (x400);
10. Part of body of female to show vulva (x950);
11. Anterior end of male (x400);
12. Posterior end of male (x400)

BIOECOLOGY OF NEMATODES IN SOIL OF A SUB-HUMID REGION. I. **HOPLOLAIMUS JOHANI** SP. NOV. AND II. **H. CAUDIFURCATUS** SP. NOV. AROUND FRUIT CROPS

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Abstract

Two new species of nematodes parasitizing soil around fruit crops, **Psidium guajava** were- **Hoplolaimus johani** sp. nov. and **H. caudifurcatus** sp. nov. The former species possessed prominent hemizonid 3 behind excretory pore in both sexes; basal head annules 6; posterior scutella (phasmid) large, situated just above the Spicule and bursa typical in not completely covering the tail tip with its posterior margins ending slightly above the tail tip. The blunt distinctly bifurcated tail is the unique characteristic of **H. caudifurcatus** sp. nov. besides other morphological characters described and illustrated. It has been compared with closer species, **H. indicus** (Indian (Sher, 1963) and Canadian (Anderson, 1983) specimens), **H. magnistylus** Robbins, 1982, **H. arachidis** Maharaju and Das, 1982 and **H. johani** sp. nov. described in this paper.

Key words: **Hoplolaimus, H. johani sp. nov., H. caudifurcatus sp. nov., Psidium guajava.**

Introduction

The investigations on dynamics of population infrastructure of nematodes in the rhizosphere soils around fruit crops in a sub-humid region at Allahabad, India revealed occurrence of phytonematodes that were hitherto unknown for Indian nemic fauna. The new nematodes of genus **Hoplolaimus** possessed unique morphological features that were compared with the closer species.

Hoplolaimus johani. sp. nov.
(Figs. 1 to 13)

20 Females: L=1.0525-1.4100, a=25.33-33.5, b=9.0-14.25, c=7.30-10.00, V=56.0%-65.0%, Spear=0.0208-0.0305, Tail annules=10-18, Isthmus=30μ-35μ (Figs. 7 to 13).

10 Males: L=0.9825-1.2835, a=25.00-34.00, b=6.0-9.0, c=31.80-37.50, Spear=0.0225-0.0250, Spicule length=0.275-0.0435, Gubernaculum=0.0352-0.0544, Bursa length=0.0448-0.073, Tail annules=15-20, Isthmus=15μ-20μ.(Figs. 1 to 6).

15 Larva: L=0.675-1.168, a=23.84-36.50, b=8.48-13.00, c=21.0-36.5, Spear=0.0208-0.0255 Female Holotype: L=0.9664, a=25.73, b=12.7, c=9.87, v=63.86%, Spear=25μ, Isthmus=30μ.

Body slightly curved ventrally. Body finely annulated, 2.5μ wide. Head strongly sclerotized, set off from the body, hemispherical .The 1st head annule slightly concave anteriorly. Basal head annules having 3-5 squares of variable size. Lateral fields not visible. Excretory pore very distinct, 119.40μm from the anterior end situated 64μm anterior to Oesophageo-intestinal valve and never close to the Oesophageo-intestinal valve. Hemizonid very prominent, 3μm below excretory pore. The location of hemizonid is almost same in most of the females examined and did not show much variation. Oesophagus 112.00μm long. Isthmus 30μm long. Basal oesophageal gland extending posterior to valve over the intestine 30μm on either lateral sides. Oesophageal gland nuclei highly variable 3-6 in number having diameter of 9.5μm. The size of nuclei is constant having no distinct variation. This shows that the number and size of oesophageal gland nuclei can not be taken as an important character of genera and species. Young females filled with different stages of germ cells. Vulva situated slightly behind the middle of the body. Vulva epiptygma double in all females examined leading into atrium. Ovary didelphic with the anterior lobe extending the entire length of the intestine posterior limb extending up to the anus. Intestine densely filled with fatty globules overlapping rectum never extending into tail. Rectum 25 μm long. Tail 30μm long more than anal body width. Tail broadly rounded, consisting of 14 annules. Mid-body width 45 μm.

Male

Allotype: L=0.92, a=24.0, b=8.7, c=30.0, Spear=0.0230, Spicule length=0.0295, Gubernaculum=0.0355, Tail annule=18, Isthmus=16μ.

Body contour similar to female. Mid-body width 74μm. Labial framework highly sclerotized, not showing sexual dimorphism. Body annulations distinctly fine approximately 1.6μ wide. Lateral fields invisible and could not be

Hoplolaimus johani. sp. nov.
(Figs. 1 to 13)

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Male

Allotype: L=0.92, a=24.0, b=8.7, c=30.0, Spear=0.0230, Spicule length=0.0295, Gubernaculum=0.0355, Tail annule=18, Isthmus=16µ.

Body contour similar to female. Mid-body width 74µm. Labial framework highly sclerotized, not showing sexual dimorphism. Body annulations distinctly fine approximately 1.6µ wide. Lateral fields invisible and could not be

seen in most of the specimens examined. The basal head annules divided into, 6 unequal blocks showing no subdivisions horizontally. Stylet 23µm with robust tulip-shaped basal knobs, 1.5µm long and 1.0µ wide. Oesophageal glandular duct opening situated 3 µ below the basal knobs. Oesophageal glands with three nuclei were showing no variation. Oesophageo-intestinal junction situated 114µ from the anterior end. Lobes extending 32µ beyond Oesophageo-intestinal junction. Nerve ring very distinct encircling Isthmus. Cephalids present anteriorly. Excretory pore, distinct 118µ from anterior end. Hemizonid present just adjacent and below the excretory pore, not as prominent as in females. Posterior scutella (Phasmid) large, conspicuous, situated 83µ from posterior ends and just above the Spicule. Testis out stretched anteriorly. Spicule 29.5µ long. Gubernaculum conspicuous, V-shaped 13µ long. The two rami almost equal in size. Bursa 51µ long, oval finely annulated, not completely covering the tail tip. The posterior margins of the bursa ending slightly above the tail tips.

Type specimens: Collected by authors in April 2000.

Holotype: Slide No.PNLS 112 /2000 deposited with the Parasitology Laboratory Department of Zoology, University of Allahabad, Allahabad, U.P, India.

Allotype- Slide No. PNLS 113/2000 deposited with the Parasitology Laboratory Department of Zoology, University of Allahabad, Allahabad, U.P., India

Type Habitat: Rhizosphere of Guava (**Psidium guajava**)
Type Locality: Roxburg Botanical Garden, Department of Botany, University of Allahabad, U.P., India

Etymology: This new species of **Hoplolaimus** is named as **Hoplolaimus johani** n.sp. in honour Dr. J.C. Edward, a pioneer worker in the field of Nematology.

Differential Diagnosis: Based on the key given by Anderson, 1983 and on the characters of species of **Hoplolaimus** from India.

Hoplolaimus johani sp. nov. comes close to **H. sacchari** (Shamsi 1979) Lue, 1981; **H. seshadri** Mulk and Jairajpuri, 1976 and **H. indicus** Sher, 1963. It resembles **H. sacchari** Lue, 1981 in having very few body incisures. Hemizonid situated posterior to the excretory pore, bisexual and having males and females in good numbers and intestine overlapping rectum. However, it differs from **H. sacchari** Lue, 1981 in having no body incisures; relatively shorter stylet (21-30 µ in female in **H. johani sp. nov.** and 31-53µ in **H. sacchari,** and 23 -25 µ in males of **H. johani sp. nov.**). Males having relatively shorter spicule length (28-44 µ m in **H. johani** sp. nov.; 39-40 µ in **H. sacchari**). It also resembles **H. seshadri** Mulk and Jairajpuri, 1976 and **H. indicus** Sher, 1963. It differs from **H. seshadri** in having basal head annules not showing longitudinal striae, head distinctly set

off and highly sclerotized and having relatively shorter body length, spear length, spicule length and location of hemizoinid posterior to the excretory pore. It also resembles some what to the canadian population **H. indicus** in having stylet length less than 45 µm, spicules les than 50 µm; head set off, body curved ventrally and hemizonid situated posterior to the excretory pore. Howerver it differes from **H.indicus** in having relatively shorter body lengh, shorter b & c values. Higher V% (V% 56-65 in **H. johani sp. nov.** and 52-57 in **H. indicus**), shorter spear lengh (31-32 µm in **H. johani** and 33-47 in **H. indicus**)

Hoplolaimus caudifurcatus sp. nov.

(Figs. 14 to 20)

Female

Holotype: L=1.017, a=19.94, b=5.91, c=42.37, V=56.6%, spear=54 µ, Isthmus=21 µ, Greatest body width (W)=0.051, Head-Exr. Pore(Ep)=0.2076, Head-base of Oesophagus(Es)=0.1688, Tail=0.024, Width at anus=0.033, Ratio A(L/W)=19.94, Ratio B(L/Es)=5.91, Ratio C (L/Tail lengh)=42.37, Ratio D(Ep/Es)=1.20%, Ratio E(Ep/Tail)%=6.29%

Worms with cylinderoid, wormiform body ending into a blunt, distinctly bifurcated tail (Fig.19). Cuticle coarsely striated. Cephalic flanges present, measure 9µ (6µ-10µ) on either side at the base of head reagion, head 5µ- 6µ long and 11µ-12µ wider, extending a little posterior to the base of stylet. Lateral flanges continue with a width of 9µ (6µ-12µ) on either side of body up to the base of tail. Mid-body width, 49µ (39µ-51µ). Head distinctly setoff, hemispherical with massive cephalic framework, usually bearing 4-5 lip annules and the oral disc. Cuticular annulations distinct, along most of the body length, measure, 1.5µ (1.2µ-2.0µ) in width. Sub-cuticular annulations distinct, upto half of the width of outer cuticular annules. Stylet long and stout measure, 54µ (52µ-55µ), basal knobs tulip-shaped, 9µ (7µ-9µ) long, 5.8µ (4µ-6µ) wide. Basal knobs consist of two anteriorly projecting processes. Oesophageal glands width more than 4 nuclei. Procarpus long and cylindrical. Median bulb oval to spheroid with well developed median valvular apparatus. Isthmus narrows and circled by nerve ring. Oesophageo- intestinal junction extends 170µ(169µ-171µ) from anterior end. Oesophageal lobes extend 215µ(211µ- 225µ) from anterior end, lobes extending 54µ(42µ-58µ) beyond Oesophageo-intestinal junction. Cephalids present on anterior extremity. Excretory pore situated 207µ(180µ-220µ) from anterior end. Hemizonid small, about one annule in length located 16(15-17) annules posterior to excretory pore. Excretory pore closer to oesophageal intestinal valve. Vulva prominent, slightly behind mid bodies a deep transverse slit. Vegina at right angle to body axis extended 21µ (16µ-24µ) deep into the body. Vulval epiptygma indistinct or absent. Ovaries two, symmetrical, outstretched with single row of oocyte. Intestine is packed with refractive granules and overlaps the rectum to varying degrees but never extends into tail. Tail consists of two distinct portions one hemispherical and the other conoid hemispherical with16 (15-20) annules. Terminal annules longer than the other body annules. The hemispherical part of

the right side of the tail has one end extending upto 25μ (22μ-27μ) towards the inner side of the body and its other outer elongated part extends upto 45μ(40μ-48μ) in length joining the rest of the body with a deep distinct furrow for beyond the actual location of anus. The other conoid hemispherical left part of the tail is shorter then the right half. Its inner flap extends upto the 19.5μ(17μ-22μ) slightly behind anus, where as its other parts continuous with a lateral body margins separated from rest of the body by slit, slightly ahead of the position of the anus, measures 37.5μ(35μ-39μ) in length. The distance of anus from tail tip is 28μ(24μ-33μ).

Male

Allotype - not found.

Type specimens - Collected by authors in May 2000.

Holotype - Slide No.PNLS 114 /2000 deposited with the Parasitology Laboratory, Department of Zoology, University of Allahabad, Allahabad, U.P., India.

Type habitat- Rhizosphere of Psidium guajava.

Type Locality- Roxburg Botanical garden, Department of Botany, University of Allahabad, Allahabad, U.P., India.

Etymology- This worm has been named as Hoplolaimus caudifurcatus on the basis of clear bifurcation of tail end that means tail end of this worm is divided into two parts.

Differential Diagnosis-

The worm of the of the present species come closer to Indian specimens of **Hoplolaimus indicus** Sher, 1963, Canadian specimens of **H. indicus** Anderson, 1983, **H. magnistylus** Robbins, 1982 and H. arachidis Maharaju and Das, 1982 in its body measurements. **H. caudifurcatus** sp. nov. has also been compared with the specimen of **H. johani** sp. nov. That has been described in the foregoing text. The worms of the new species have shown a distinctive feature from the all the aforesaid valid species in division of the tail into two parts, of which one is hemispherical and the other is conoid hemispherical. The other characters differentiating it from Indian population of **H. indicus** are possessing 4 annules in the lip region, larger stylet with anteriorly projected knobs, longer Oesophagus. **H. caudifurcatus** sp. nov.. was comparable with Canadian specimens of **H. indicus** in having smaller body length, longer stylet, smaller ratio of body length to oesophageal length, smaller ratio of body length to tail length. Greater distance of excretory pore from anterior extremity, hemizonid located far more distantly to

excretory pore (15 body annules in this new species vs. 1-8 annules in **H. indicus**) and a longer tail. New species could also be differentiated from **H. magnistylus** in possessing a smaller body, much smaller ratio of body length to width, smaller ratio of body length to oesophageal length (b), longer tail and greater ratio of body length to tail length (c). The worms of the new species differed from **H. galliatus** in possessing a longer stylet, a more posterior hemizonid to excretory pore and in the absence of vulval epiptygma. Finally **H. caudifurcatus** sp. nov.. could also be differentiated from **H. arachidis** in having smaller worms, smaller "b" and "c" values, shorter but wider head, longer stylet, shorter distance of excretory pore from anterior end, hemizonid distinct , greater extension of vagina into the body, and intestine overlap rectum on longer tail.

Acknowledgements

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Explanation of figures

Figs. 1-13: H. johani sp. nov.

1) Photomicrograph of anterior end of male (magnified) (x950).
2) Anterior end of male (magnified) (x400).
3) Photomicrograph of posterior end of male (dorsal view) (magnified) (x950).
4) Photomicrograph of posterior end of male (lateral view) to show bursa and spicules (magnified) (x950).
5) Posterior end of male (magnified) (x400).
6) Photomicrograph of male showing posterior end (lateral view) to show bursa and spicules (magnified) (x950).
7) Photomicrograph of W.M. of female (x190).
8) Photomicrograph of anterior end of female (magnified) (x950).
9) Anterior end of female (magnified) (x400).
10) Photomicrograph of vulva (magnified) (x950).
11) Vulva (magnified) of female (x400).
12) Photomicrograph of posterior end of female (magnified) (x950).
13) Posterior end of female (x400).

Figs. 14-20: H. caudifurcatus sp. nov.

14) Photomicrograph of female (x190).
15) Photomicrograph of anterior end of female (magnified) showing cephalic flanges (x950).
16) Anterior end of female (magnified) to show Oesophagus (x400).
17) A. Photomicrograph of female showing magnified view of vulva (x950).
    B. Photomicrograph of female showing magnified view of vulva (x950).
18) Vulva (magnified) (x400).
19) Photomicrograph of posterior end of female (magnified) to show bifurcation of tail (x950).
20) A. Posterior end of tail (lateral view) of female to show bifurcation of tail (magnified) (x400).
    B. Posterior end of tail (dorsal view) of female to show bifurcation of tail (magnified) (x400).

Table 1. Body measurements of female worms of **H. johani** sp. nov.

Character	Minimum	Maximum	Mean	±S.E.
Length (L)	0.966	1.398	1.182	0.108
Greatest-width (W)	0.032	0.046	0.039	0.003
Head-Excr.pore (EP)	0.0896	0.122	0.106	0.008
Head-Base of Oeso. (ES)	0.045	0.144	0.074	0.03
Tail	0.026	0.029	0.027	0.0008
Width at Anus				
Ratio A (L/W)	25.50	33.61	29.55	2.02
Ratio B (L/ES)	9.8	14.25	12.02	1.11
Ratio C (L/Tail length)	7.3	15.6	11.45	2.07
Ratio D (EP/ES)%	0.84	2.0	1.42	0.29
Ratio E (EP/Tail)%	3.5	4.22	3.86	0.18
Vulva (V)%	56.0	65.0	60.5	2.25

Table 2. Body measurements of male worms of **H. johani** sp. nov.

Character	Minimum	Maximum	Mean	±S.E.
Length (L)	0.992	1.282	1.138	0.072
Greatest-width (W)	0.021	0.042	0.031	0.005
Head-Exr. pore (EP)	0.090	0.128	0.109	0.009
Head-Base of Oeso. (ES)	0.054	0.166	0.110	0.028
Tail	0.026	0.032	0.09	0.001
Width at Anus				
Ratio A (L/W)	24.0	33.4	28.7	2.35
Ratio B (L/ES)	7.20	20.06	13.63	3.21
Ratio C (L/Tail length)	30.0	41.75	35.87	2.93
Ratio D (EP/ES)%	0.77	1.66	1.21	0.22
Ratio E (EP/Tail)%	3.50	4.0	3.75	0.125

Table 3. Body measurements of female worms of **H. caudifurcatus** sp. nov.

Characters	Minimum (μm)	Maximum (μm)	Mean. (μm)	±S.E.
Length (L)	1.017	1.107	1.062	0.022
Greastest width (W)	0.032	0.051	0.041	0.004
Head-Excr.pore (EP)	0.208	------	------	-------
Head-Base of Oeso. (ES)	0.169	0.172	0.170	0.0007
Tail	0.024	0.033	0.029	0.002
Width at Anus	0.024	0.033	0.029	0.002
Ratio A (L/W)	19.94	32.28	26.11	3.08
Ratio B (L/ES)	5.91	6.02	5.965	0.028
Ratio C (L/Tail length)	30.81	42.37	36.59	2.89
Ratio D (EP/ES)%	1.20	1.22	1.21	0.005
Ratio E (EP/Tail)%	6.29	8.65	7.47	0.59
Vulva (V)%	54.00	58.00	56.00	0.50

BIO-ECOLOGY OF PARATYLENCHUS GUAJAVAI SP. NOV. OF SUB HUMID- REGION AROUND FRUIT PLANTS

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Abstract

The new species of nematodes belonging to the super family Criconematoidea found in the rhizosphere soil of fruit plants Psidium guajava is figured and described.

Keywords: Paratylenchus, Paratylechus guavajavai, and Psidium guajava.

Introduction

The investigations carried out in the rhizosphere soils around fruit plants Psidium guajava of a sub humid region situated at 100 m ASL at Allahabad, U.P. India where found to harbor a new species of Paratylenchus.

Paratylenchus guvajavai sp. nov.

(Figs.1 to 4)

20 Females : L = 0.378 - 0.56, a = 21.93 - 33.7, b = 7.86 - 21.62, b = 7.0 - 17.4, c = 7.86 - 15.7, O = 79.9, V = 67.4 - 86.3, VL / VB = 0.46 - 4.6, VL / ST = 0.66 - 6.6, Stylet = 0.0144 - 0.24, Isthmus = 0.0048 - 0.0336.

10 Males : L = 0.323 - 0.5056, a = 22.57 - 33.75, b = 4.93 - 18.0, c = 12.35 - 22.5, T = 22.0 - 30.0, Gurbernaculum = 0.005 - 0.006, Spicule length = 0.009 - 0.018, Bursa length = 0.0144 - 0.016, Isthmus = 0.011 - 0.014.

Female Holotype: L = 0.544, a = 21.93, b = 12.14, b = 17, c = 9.44 v = 67.4, VL / VB = 24.82, VL / ST = 37.89, stylet = 0.0152, Isthmus = 4 mm.

Body arcuvate on death, 0.544 mm long and 0.0224 mm wide in the mid region. Body tapering at both ends, ends ventrally curved in normal position. Cuticle well marked with transverse striae. Lip region truncate-conoid, slightly sclerotized, continuous. Lateral field conspicuous marked by striae. Amphids not seen. Head poorly sclerotized and continuous with the body. First head annule narrowly conical. Lateral fields visible marked by incisures. Cones of stylet seen 2.5 times as long as shaft. Knobs small and laterally directed. Excretory pore very distinct located at the distal end of base of oesophageal basalbulb. Stylet prominent 15 mm long. Isthmus 4 mm long. Vulva prominent, transverse slit leading in to vagina without vulval flaps, situated slightly below the mid body. Tail conically rounded.

Male allotype: L = 0.5056, a = 22.57, b = 4.93, c = 17.55, T = 28.0, Stylet = 0.01344, Gubernaculum = 0.0058, Spicule length = 0.014, Bursa length = 0.016, Isthmus = 15 mm.

Males not common, body cylindrical, ventrally arcuvate on death. Cuticle marked by fine transverse striae. Head smooth, conical and continuous with body, tapering anteriorly. Stylet degenerate. Oesophagus highly degenerate. Maximum body width 0.022 mm. at midbody. Excretory pore located clearly visible mm. from interior end. Hemizonid present in front of the excretory pore, located mm. behind anterior end. Cephalic region conoid rounded. Spicule paired 0.014 mm. long. Bursa completely was covering the tail. Tail slender conoid with acute terminus. Testis monodelphic, anteriorly outstretched, filled with sperms at different stages of development. Spicules ventrally arcuvate with bluntly pointed proximal end. Gubernaculum short, concaves, measuring 4 mm. caudal alae absent.

Type specimens: Collected by authors in May 2000.

Holotype : Slide No. PNLS 115 / 2000 deposited with the Parasitology Laboratory, Department of Zoology, University of Allahabad, Allahabad, and U.P., India.

Allotype : Slide No. PNLS 116/2000 deposited with the Parasitology Laboratory, Department of Zoology, University of Allahabad, Allahabad, and U.P., INDIA.

Type Habitat: Rhizosphere of Guava (Psidium guajava).

Type Locality: Roxburg Botanical Garden, Department of Botany, University of Allahabad, Allahabad, and U.P., India.

Etymology : Present new species of Paratylenchus is named as Paratylenchus guvajavai n. sp. based on the specific name of the host plant Psidium guajava.

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Diagnosis : Paratylenchus having continuous lip region, a short buccal spear (15.5 mm.), post-uterine sac absent, spermatheca situated above uterus, vulval sheath absent, no marked reduction between pre and post vulval diameter and 65 post-vulval annulations; and males with broadly conical, unsclerotized, smooth head, continuous with the body contour, annules less than 1 mm. wide, excretory pore situated mm. from anterior end and presence of Hemizonid above excretory pore.

Diagnosis based on the keys given by Jenkins (1956) and Oostenbrink (1960) in the possession of truncate-conoid Lip region, vulva about 80% and the absence of the post uterine branch of the gonad Paratylenchus guajavai n.sp. Comes close to P. projectus Jenkins (1956). This Paratylenchus guajavai hits into the curvilatus group suggested by Geraert (1956). However it differs from P. projectus in having a Lip region which is continuous and not off-set, an average stylet length 20 mm. as against 32 mm., absence of marked reduction in body diameter below vulva and presence of spermatheca:

It also comes close to P. nainianus; Edward and Mishra (1963) in having similar distribution around Allahabad, continuous Lip region, absence of post uterine branch and degenerate males. However it differs from P. nainianus; Edward and Mishra (1963) in having relatively longer body length (0.27-0.34 in P. nainianus), higher a and b valued (a=21.0-26.0;b=3.0-4.5 in P. nainianus), lower c and v values (c=19.0-22.0; v=80.0-85.0 in P. nainianus), relatively shorter spear (21-26) mm. in P. nainianus) and having larger number of post-vulval annulations (50 post-vulval annulations in P. nainianus).

References

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Explanation of Figures

1. Photomicrograph of anterior end of male P. guajavae sp. nov.
2. Photomicrograph of posterior end of male P. guajavae sp. nov.
3. Photomicrograph of anterior end of female P. guajavae sp. nov.
4. Photomicrograph of posterior end of female P. guajavae sp. nov.